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Journal of the Society of Arts.

FRIDAY, FEBRUARY 21, 1868.

Announcements by the Council.

ARTISANS' REPORTS ON THE PARIS EXHIBITION.

The Reports of the Artisans selected by the Council to visit the Paris Exhibition are now ready, and may be had of the Society's publishers, Messrs. Bell and Daldy, York-street, Covent-garden. One volume; demy 8vo., 732 pages, price 2s. 6d. in boards, or 3s. 6d. in cloth. The volume contains reports, by upwards of eighty artisans, upon the principal industries represented in the Exhibition, as well as special reports on the condition and habits of the French working classes.

ORDINARY MEETINGS.

Wednesday evenings, at Eight o'clock:—

FEBRUARY 26.—"On a Daily Mail Route to India." By HYDE CLARKE, Esq., D.C.L.

MARCH 4.—"A Workman's Views on Technical Education." By Mr. JOHN RANDALL, one of the Artisan-Reporters on the Paris Exhibition.

ART-WORKMANSHIP COMPETITION.

The works of the competitors, which are now arranged in the Great Room for the inspection of members and their friends, will only be on view up to and including Saturday, the 29th inst.

NOTICE TO MEMBERS.

The Council have placed the Great Room at the disposal of the Society for the Encouragement of the Fine Arts on Thursday evening, the 27th inst., when a Paper upon the Works of James Barry, R.A., will be read by Mr. F. Y. Hurlstone. A limited number of tickets of admission have been kindly forwarded to the Secretary of the Society of Arts, to whom any members who may desire to be present should apply.

INSTITUTIONS.

The following Institution has been received into Union since the last announcement:—
Beauvoir College Evening Classes.

SUBSCRIPTIONS.

The Christmas subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

ELEVENTH ORDINARY MEETING.

Wednesday, February 19th, 1868; BENJAMIN SHAW, Esq., Member of the Council, in the Chair.

The following candidates were proposed for election as members of the Society:—

Johnson, Matthew Hawkins, 379, Euston-road, N.W.
Roe, Thomas, jun., Mayor of Derby.
Sarll, John, Drapers'-hall, Throgmorton-street, E.C.
Wise, William Lloyd, Chandos-chambers, Buckingham-street, Adelphi, W.C.

The following candidates were balloted for, and duly elected members of the Society:—

Baker, William Procter, Clifton, Bristol.
Byatt, Horace, St. Mary's School, Chatham.
Chapman, Henry, 41, Boulevard Malesherbes, Paris.
Harrington, Sir John, Bart., 58, Eaton-place, S.W.
Pembroke, James, The Academy, East-street, Hereford.
Scott, W. B., C.E., St. Pancras Vestry, Edward-street, Hampstead-road, N.W.
Westerton, Charles, 27, St. George's-place, Hyde-park-corner, S.W.

The Paper read was—

ON THE SUPPLY OF ANIMAL FOOD TO BRITAIN, AND THE MEANS PROPOSED FOR INCREASING IT.

By WENTWORTH LASCELLES SCOTT, F.A.S.L.,
F.R.S.S.A., &c.

In compliance with the request of several members of this Society, I have promised to ask your attention this evening to the subject of our national meat-supply—a subject of vital importance, and one which has too long been neglected in this country.

At the present moment, the newly-awakened interest in the "great food-question" cannot fail to be productive of substantial results, but it is undeniable that such results might have been arrived at just as well many years ago, thus in some measure preventing the occurrence of those very evils we are now at the eleventh hour attempting to remedy.

The chief points proposed for your consideration and discussion to-night may be rendered as follows:—

I. What quantity of animal food is required per head of the population per annum?

II. What amount is actually available? And

III. How shall we best supply the deficiency, if any?

I hope, under other circumstances—viz., in the course of a somewhat ponderous volume, as yet in embryo*—to deal with these and certain other questions in their several details, but now I simply have to ask your kind indulgence while I lay before you a few brief, and it may be disjointed, observations, believing as I do that all deficiencies on my part will be more than compensated for by the valuable statements and opinions the mere mention of animal food is sure to elicit.

Starting with the first division of our subject, I feel I am upon rather delicate ground, having the misfortune to differ a little in opinion with some of our highest authorities in relation to the consumption of food. I will endeavour, however, to keep all such heterodox ideas in the background, as far as practicable, upon the present occasion.

I have considered, from data too lengthy and complex to trouble you with just now, that in this country and climate, 1342 grains of nitrogenous or flesh-forming

* "The Food Resources of the British Empire."

matter per head of the population are required each day, if the inhabitants of the British Isles are to be maintained in the highest (average) condition of physical and mental activity, and that of this quantity four-tenths, or 536 grains, should be furnished by animal food, and three-tenths, or 402 grains, in the form of meat.

I have further assumed that meat, as a whole, contains upon the average 13 per cent. of assimilable nitrogenous matter, and although there may be some present who do not quite agree with these estimates, I think I may fairly believe that any differences will be too small to affect the main arguments of this paper.

It is remarkable that even Londoners, who consume a larger proportion of animal food, as a rule, than is accorded to the other nine-tenths of the population, do not get the necessary quantity, or anything approaching to it, the meat-deficiency for the metropolis only, amounting to upwards of 102,000,000 lbs. at the lowest computation. In round numbers, I consider that Great Britain, to be well and rationally fed, requires an addition to her meat supplies of fully 3,544,330,000 lbs. annually.

Our next point—what amount of animal food is actually available—is a somewhat formidable question, and one, too, upon which opinions differ pretty widely; however, if we make a rule of taking the lowest rational figures for our requirements, and the highest for our supplies, our general deductions therefrom must certainly be under the truth. In furtherance of the objects of my future work, I have necessarily been at some pains to acquire information of the ordinary food-produce of this country, and I cannot help observing that there are few things more difficult to obtain, or more unsatisfactory when you have got them, than British agricultural statistics. Mr. Matchwick, in the general introduction to the catalogue of the British Section of the Paris Exhibition, writes:—"As regards the productions of the soil, there are, unfortunately, no official returns of the quantity of corn, meat, wool, or of butter, cheese, or other dairy produce annually produced. In this respect England is far behind most continental nations, where for years past a complete series of agricultural statistics has been in operation. Until 1866, no complete returns for the whole kingdom, or even the average and number of live stock, were obtained."

As if to ensure the least possible degree of utility to the two years' imperfect statistics we have been favoured with, these returns are taken before and after the lambing season in 1866 and 1867 respectively, crediting us with an increase of mutton of nearly 30 per cent. on the previous year, or 7,422,553 sheep, whereas there is but too good reason to believe that a slight proportionate decrease has taken place. Then, again, in these returns a summary of which I append here, the errors and omissions are numerous. In one county alone, to my personal knowledge, the number of animals was incorrect in nine instances, and omitted altogether in four other cases. However, now that an attempt at agricultural statistics has been made, I hope we shall go on improving and extending them, if only in our nationally tardy manner.

TOTAL NUMBER OF EACH KIND OF LIVE STOCK IN THE UNITED KINGDOM.

| | 1866. (Returns taken before Lambing.) | | |
|--------------------|--|-----------|-----------------|
| | Great Britain. | Ireland. | United Kingdom. |
| Cows | 1,883,522 | 1,482,616 | 3,366,138 |
| Other cattle | 2,902,314 | 2,263,541 | 5,165,855 |
| Total cattle.. | 4,785,836 | 3,746,157 | 8,531,993 |
| Sheep | 22,048,281 | 4,274,282 | 26,322,563 |
| Pigs..... | 2,477,619 | 1,497,274 | 3,974,893 |

| | 1867. (Returns taken after Lambing.) | | |
|--------------------|---|-----------|-----------------|
| | Great Britain. | Ireland. | United Kingdom. |
| Cows | 2,038,092 | 1,519,720 | 3,557,812 |
| Other cattle | 2,954,942 | 2,182,658 | 5,137,600 |
| Total cattle.. | 4,993,034 | 3,702,378 | 8,695,412 |
| Sheep | 28,919,101 | 4,826,015 | 33,745,116 |
| Pigs..... | 2,966,979 | 1,233,893 | 4,200,872 |

My own estimate (for 1868) is as follows for the United Kingdom:—

| | Number of Animals. | Average Weight of Meat. |
|-------------------|--------------------|-------------------------|
| Total Cattle..... | 9,300,000 | 400 lbs. |
| Sheep | 34,560,000 | 45 " |
| Swine | 4,940,000 | 60 " |

Now, various opinions have been given as to the number of animals slaughtered for food per annum, and the quantity of "butchers' meat" yielded by each variety; some of these are so extravagant as to be without the pale of rational hypothesis altogether. Care, inquiry, and comparison of actual results have led me to believe that, taking one animal with another, the annual number slaughtered cannot exceed 23 per cent. of the existing live stock. Cattle, sheep and lambs, and pigs, I consider, yield 400 lbs., 45 lbs., and 60 lbs. each of trimmed meat, and, therefore that only 1,281,468,000 lbs. can be available for consumption in the British Isles during the present year, or less than 2 oz. of meat (including bone and fat) per head of the population per diem.

I need scarcely dilate upon this terrible deficiency; however much opinions may differ in points of detail, I think the main fact is sufficiently self-evident. At the first glance the metropolis appears more favoured; it consumes, without doubt, about three times this proportion of meat; but this seeming advantage is not so in reality, for several reasons—one being the number of hotels, institutions, and large establishments where the waste is very great, and another, the peculiarly dyspeptic character of the majority of City occupations, occasioning much (comparative) difficulty in the assimilation of food.

There are, without doubt, numerous obstacles in the way of a fair estimation of the amount of animal food available for consumption in this country; but if we take London as being certainly found in the possession of a larger amount of animal food than any other tenth part of the population, and yet find it to be lamentably deficient in its meat-supplies, it is not too much to say that the entire country is in a state of mitigated starvation. There is a section of the public, which, doubtless, has some representatives here to-night, who cannot grasp this fact; they consider it would be simply monstrous if it did exist; and so the kindly wish being father to the thought, it of course cannot be; figures, which but few people take the trouble to go into, can be so easily exaggerated, &c. Some few of our popular writers, too,—I could point to several instances—have unconsciously done harm by impressing the popular mind with graphic descriptions of the enormous quantities of food—some of it brought from the uttermost ends of the earth—consumed by great cities, without, at the same time, exhibiting the utter inefficiency of the same to supply the real requirements of our "teeming millions."

In the consideration of supply and demand, prices will help us considerably, and we may derive some little instruction from a comparison of the cost of meat some

years ago and at present. I do not mean the time (1490) when "3 shepe" could be bought for a crown, a "lambe" for sixteen pence, and "6 pyggs" might be obtained at the very moderate figure of two shillings, while a "bushell of whete" cost ten-pence halfpenny.* but say we begin with 300 years later.

In 1789-90, according to Mr. Arthur Young, our prices for animal food were:—

| | |
|--------------|--------------------|
| Beef | 3½ to 3¾d. per lb. |
| Veal | 3¾d. " |
| Mutton | 3¾d. " |
| Pork | 4½d. " |
| Butter | 8½d. " |
| Cheese | 4½d. " |

while, at the same period, the market value of the services of that favourite Parliamentary standard, "the Dorsetshire labourer," amounted to 1s. 4¾d. per diem.

The contract prices of butchers' meat per cwt. at Greenwich Hospital, since 1735, have been as below:—

| Year. | Price per cwt. | Year. | Price per cwt. |
|------------|----------------|-------------------------|----------------|
| 1735 | 0 16 11 | 1836 | 2 1 3½ |
| 1740 | 1 8 0 | 1837 | 2 10 10½ |
| 1745 | 1 2 2 | 1838 | 2 2 5 |
| 1750 | 1 6 6 | 1839 | 2 7 7½ |
| 1755 | 1 7 9½ | 1840 | 2 14 0 |
| 1760 | 1 11 6 | 1841 | 2 16 0½ |
| 1765 | 1 7 3 | 1842 | 2 12 8½ |
| 1770 | 1 8 6 | 1843 | 2 0 1 |
| 1775 | 1 13 5 | 1844 | 2 0 10 |
| 1780 | 1 12 6 | 1845 | 2 6 9 |
| 1785 | 1 17 6½ | 1846 | 2 3 4½ |
| 1790 | 1 16 10 | 1847 | 2 14 5½ |
| 1795 | 2 2 10 | 1848 | 2 11 7 |
| 1800 | 3 4 4 | 1849 | 2 1 5½ |
| 1805 | 3 0 4 | 1850 | 2 2 1 |
| 1810 | 3 12 0 | 1851 | 2 0 9 |
| 1815 | 3 8 0 | 1852 | 2 3 4½ |
| 1820 | 3 10 4½ | 1853 | 2 13 1 |
| 1821 | 2 18 10 | 1854 | 3 0 0½ |
| 1822 | 1 19 5½ | 1855 | 2 18 9 |
| 1823 | 2 2 7½ | 1856 | 2 14 1 |
| 1824 | 2 2 8½ | 1857 | 2 12 10½ |
| 1825 | 2 19 6½ | 1858 | 2 10 2½ |
| 1826 | 2 17 8 | 1859 | 2 13 3½ |
| 1827 | 2 15 4½ | 1860 | 2 17 9 |
| 1828 | 2 10 7½ | 1861 | 3 0 4 |
| 1829 | 2 6 3½ | 1862 | 2 17 3½ |
| 1830 | 2 3 6 | 1863 | 2 16 10½ |
| 1831 | 2 4 3½ | 1864 | 3 2 8½ |
| 1832 | 2 6 2½ | 1865 | 3 12 7 |
| 1833 | 2 6 6 | 1866 | 3 5 4 |
| 1834 | 2 3 9 | 1867 | 3 10 0 |
| 1835 | 2 0 7½ | 1868 (to 31st of March) | 3 10 0 |

(Signed) THOMAS WILSON,
Capt. Supt. Greenwich Hosp.

February 18th, 1868.

The meat contracted for is of "prime" quality, the beef being almost entirely without bone, and the mutton consisting entirely of legs and loins. T. W.

I need not dwell much upon later prices, for I see in this room many who are in a position to speak with authority upon this point, but to bring the figures down to our own time, I will insert here a brief note of the London market prices of last winter, and those of seventeen years ago.

| Description of Meat. | Prices per 8 lbs. | | | Prices per 8 lbs. | | | Mean increase | |
|----------------------|--------------------|-------|-------|--------------------|-------|-------|---------------|-----------|
| | Winter of 1850-51. | | | Winter of 1866-67. | | | in Price. | |
| | Min. | Max. | Mean. | Min. | Max. | Mean. | Per 8 lbs. | Per Cent. |
| Beef | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | |
| Mutton | 3 0 | 4 4 | 3 3 | 3 10 | 6 2 | 5 0 | 1 4 | 33·3 |
| Veal | 2 8 | 3 8 | 3 2 | 4 6 | 5 6 | 5 0 | 1 10 | 57·9 |
| Pork | 3 0 | 3 8 | 3 4 | 3 2 | 4 2 | 3 8 | 0 4 | 11·1 |

By which we see that beef and mutton have increased in price 33·3 and 36·3 per cent. respectively, in about the sixth of a century. At this rate, where should we be in 1968?

If further proof were wanting, that meat, as a primary

* Parish books of Kingston-on-Thames.

necessity of our national existence, costs very considerably more than we can afford to pay for it, I need only point to those panaceas for all British sorrows—letters in the *Times*, which have for many months past almost consoled the writers for the condition of their butchers' bills on the one hand, while they did good service in awakening public attention on the other.

I was speaking on the same subject to a friend, not long ago, when he remarked, "Why don't the people eat fish, if meat is so dear and so scarce? I have seen more fish thrown away, or allowed to decay for manure, within a few days, than would be required to keep Southampton in animal food for a month." And this observation brings us to another subdivision of our subject—the supply of fish. Here, again, the same melancholy story holds good—the supply is but a fraction of the demand—while, in addition, we are forced to the humiliating confession that many thousands of tons of fish are being thrown away and absolutely wasted after they have been caught, in a country where 23,000 people die annually from insufficiency of food. Moreover, it is not only that fish, as a rule, is dear now, as compared with former times (when it was by no means uncommon for articles of indenture to contain a clause stipulating that the apprentice was not to have salmon for dinner more than two or three times a week!*), but we have the anomaly constantly occurring of a starving population in one part of the country, simultaneously with the absolute destruction of many tons of nutritious food in another.

TABLE SHEWING THE NUMBER, WEIGHT, AND VALUE OF THE FISH CONDEMNED AND DESTROYED AT BILLINGSGATE IN 1867.

| Name of Fish. | Quantity condemned. | Weight. | Value. |
|-------------------------------|---------------------|---------|-----------|
| | | lbs. | £ s. d. |
| Salmon | 75 fish | 750 | 50 0 0 |
| Cod | 31,683 " | 316,830 | 3,973 0 0 |
| Haddock | 170,964 " | 341,928 | 4,274 0 0 |
| Soles | 2,688 " | 672 | 67 0 0 |
| Mackarel | 2,880 " | 2,880 | 30 0 0 |
| Herrings | 94,473 " | 18,895 | 190 0 0 |
| Sprats | 47 bushels | ... | ... |
| Eels | ... | 730 | 10 0 0 |
| Plaice | 115,951 fish | 115,951 | 386 0 0 |
| Dabs | 86,938 " | 14,729 | 37 0 0 |
| Whiting | 199,330 " | 66,443 | 1,660 0 0 |
| Mullet | 483 " | 322 | 12 0 0 |
| Turbot | 224 " | 896 | 112 0 0 |
| Cod roes | 2 bushels | ... | ... |
| Smelts | 114,788 fish | 5,740 | 574 0 0 |
| Brills | 292 " | ... | 3 13 0 |
| Bream | 188 " | ... | ... |
| Gurnets | 60,000 " | ... | ... |
| Ling | 505 " | ... | ... |
| Skate | 323 " | ... | ... |
| Thornbacks | 6,426 " | ... | ... |
| Caplins | ... | 120 | 3 0 0 |
| Shrimps | 9,320 gallons | ... | 466 0 0 |
| Lobsters | 840 fish | 1,260 | 1 0 0 |
| Crabs | 1,242 " | 1,242 | 1 5 0 |
| Sturgeon | 1 " | ... | ... |
| Trout | 99 " | 125 | ... |
| Cat fish | 36 " | ... | ... |
| Mussels | 100 bags | ... | ... |
| Whelks | 97 bags | ... | ... |
| Pike | 7 fish | ... | ... |
| Sardines | 2 barrels | ... | ... |
| Hake | 5 fish | ... | ... |
| Dorps | 5 " | ... | ... |
| Winkles | 141 bags 42 bshls. | ... | ... |
| Cod sounds | ... | 560 | ... |
| Dry salmon | 40 fish | 280 | 9 0 0 |
| Lampreys | ... | 20 | ... |
| Colefish | 46 fish | ... | ... |
| Preserved lobsters in tins .. | 135 tins | 135 | 3 7 6 |
| Dry cod | ... | 15,680 | 196 0 0 |

NOTE.—The value has been inserted only in those instances where the opinions received were tolerably concordant. I have great pleasure in acknowledging the kind services of Mr. Henry Graham in connection with this table.

* I am indebted for information on this and other points to J. H. Latham, Esq., of Bristol, whose kind services I desire to acknowledge gratefully.

It is excessively difficult to obtain anything like accurate information respecting the annual consumption of fish in this country, but the supply is manifestly quite unequal to the wants of the population; and although it is now probable that our national fisheries will be developed upon an organised system in future years, a considerable period must necessarily elapse before this source of "animal food" can be restored to its legitimate position. With the view of avoiding all temptations to political discussion in this room, I have decided to refrain from offering any observations on the management, or mismanagement, of our fisheries upon the present occasion, but I may appropriately refer here to the sound and practical treatise upon "The Sea Fisheries of Ireland," issued within the last few days by John R. Blake, Esq., M.P. for Waterford, as containing a large amount of most useful information, and numerous valuable suggestions, which, if carried into effect, can scarcely fail to give additional employment to one section of the community and increased supplies of food to all.*

Mr. Blake, in his "Summary and Appeal to Government," says:—"The best argument in favour of Government adopting the means for the resuscitation of the Irish Sea Fisheries recommended by the late Select Committee is the fact that, with upwards of 2,200 miles of coast, the seas abounding with fish, with a hardy, courageous population, ready to engage in any industry affording the means of life, nearly half the supply required for their own consumption is drawn from other countries. The whole capture (under £350,000 worth a year) would not supply London for one month. This is the more extraordinary when down to a comparatively late period large sums were paid by foreign nations for the privilege of fishing on the Irish coasts; that the latter were long preferred by English and Scotch fishermen to their own; and that Ireland, after supplying her own wants, exported large quantities of fish."

After reverting to the causes of the "decline and fall" of the fisheries, Mr. Blake concludes his suggestions for their improvement in these words:—"A free grant of a single shilling is not asked. A loan of fifty thousand pounds (including £10,000 for curing-houses) on approved security, is all that is suggested. That it would take some time to bring things right there can be no doubt, but that the above sum, spread over a number of years and kept circulating, would ultimately bring the fisheries to a satisfactory position, by encouraging the formation of small local companies (the most likely to succeed in Ireland) and assisting the individual fishermen to obtain better boats and gear, is believed by those most competent to pronounce. With this, of course, the present outlay on harbours should continue, and an effective department organised for the control and direction of the fisheries."

* After dwelling in forcible language upon the peculiar capabilities of Ireland for supplying not only herself, but other countries with fish, and the several causes which induced a decline in this trade, Mr. Blake gives the following succinct synopsis of the condition of Irish fisheries during the last half century:—

"1818-9.—Fisheries suffering from depression after the Union, and just before the new board had commenced operations; 27 vessels, 188 men.

"1830.—Last year of existence of board, and stimulus of bounties and loan funds; 13,110 vessels and boats; 64,771 men and boys.

"1845.—2,371 first-class vessels; 17,512 second-class.

"1846.—Immediately before the famine, 19,893 vessels; 113,078 men and boys.

"1848.—15,932 vessels and boats, representing 1,449 of 15 tons and upwards, and 14,483 under 15 tons; 70,011 crews, consisting of 66,150 men and 3,851 boys.

"1866.—9,444 vessels and boats, and 637,479 crews, consisting of 1,247 vessels of 15 tons and upwards, and 8,197 boats under 15 tons; 37,479 men, and 3,184 boys.

"Number of miles of maritime boundaries—2,346, extending through 451½ parishes; population of district in 1841—1,854,965.

"It will be seen from the foregoing that although all encouragement was withdrawn in 1830, the coast population must have made tremendous efforts to avail themselves of the fisheries, from the great increase in the number of craft and fishermen between 1836 and 1846. Notwithstanding the comparatively large number in the latter year, the best authorities pronounced that there was ample employment for more than double the vessels and men then employed."

From personal inquiries, and information I have specially collected, I am of opinion that our English, Scottish, and Irish Fisheries might be, if carefully and judiciously developed, increased to 3, 2½, and 5½ times their present degree of productiveness respectively, while at the same time it would be possible materially to decrease the number of (able-bodied) paupers in the three kingdoms.*

Another variety of animal food—that derived from the feathered tribe—calls for a passing notice at our hands, but chiefly we may observe how small a proportion it bears in comparison with meat and fish. My estimates are that London consumes nearly 22,000,000 lbs. of poultry (including larks) annually, and that the entire kingdom does not account for more than 26,500,000 lbs.; except as a speciality, therefore we may fairly ignore birds almost completely in reckoning up the nation's food.

Something like 1,300 millions of eggs are annually consumed in the United Kingdom, and I have no doubt but that quantity will steadily increase for some time to come.

Reverting for a moment to animal food as a whole, there are yet two points upon which I hope to acquire much information to-night from the practical authorities present in this room. The first is of insufficient supplies accorded to us, and credited in the national food account, how much is destroyed or rendered useless before it reaches our mouths?

In a communication I had the honour of making to this Society in 1861, † I stated this quantity in the metropolis to be about 9·5 per cent., and later inquiries have not modified this opinion, considering bad meat (from all causes) as waste, whether it is actually destroyed or not; taking the entire country, however, this proportion may be lowered to 7·25 per cent., according to my calculations. The other question referred to just now is this,—in what manner is a country affected by a supply of animal food totally inadequate to its requirements?

Now, I will candidly admit that I have committed this query to paper from a purely selfish motive. There must be many around me on the present occasion who have had special opportunities of forming opinions thereon. In 1846 Dr. Farr read an elaborate paper before the Statistical Society of London, on the "Influence of Scarcities and High Prices of Wheat on the Mortality of the People of England," ‡ in which he demonstrated that, taking all England, for every 13 deaths that occurred in the years when the average price of wheat was low, 14 persons died (out of the same population) in the years when corn was dearer, while in Lancashire and Cheshire, under similar circumstances, the deaths were seven and eight respectively. Taking meat prices as the index of mortality, the stubborn statistics pointed in the same direction, inculcated the same lesson, which may be reduced to the legend—that the rate of mortality rises with the cost of food-staples, or, in other words, that they who take a fraction off the price of meat save the lives of thousands of their countrymen. Nor does the relation stop here, for if we can trace a connection between cheap food and life, dear food and death, it follows that the mental and physical powers of a nation must be largely influenced by the character of its food supply. Of this fact in its broad bearings we find instances everywhere, food having always played an important part in the formation or modification of race-character. Every country has, if we trace it rightly, its own peculiar standard of nutrition, upon the due preservation of which depend greatly the health and welfare of its people.

The very limited time at my disposal to night, and the very expansive nature of the subject I have the honour

* This part of the subject may, perhaps, be specially treated of hereafter, should a fitting opportunity occur.

† "On Food, its Adulterations, and the methods of detecting them."—*Journal*, Vol. IX., p. 153.

‡ *Journal of the Statistical Society of London*, Vol. IX., p. 168.

of inviting you to discuss, forbid my dwelling longer upon what might be termed the population-effects of food supply, but, however much our opinions may vary as to degree, I am sure we are all ready to admit that the "Roast Beef of Old England" is a very good thing indeed, with one serious drawback—we can't get enough of it.

Now comes the question—How can we most readily increase the supply?

1st. What margin is there for the development of our own beef and mutton?

The area of the United Kingdom amounts to 77,394,433 acres, which is made up in this manner:—

| Country. | Area capable of Cultivation. | Total Area. |
|----------------------|------------------------------|-------------|
| | Acres. | Acres. |
| England | 29,086,000 | 32,342,000 |
| Scotland | 11,215,000 | 19,723,930 |
| Ireland | 17,025,280 | 19,441,744 |
| Wales | 3,647,000 | 4,752,000 |
| Channel Islands..... | 549,690 | 1,119,157 |
| Total | 61,522,970 | 77,378,831 |

Mr. Joseph Fisher, of Waterford (to whom I beg to express here my appreciation of his great courtesy), puts the case thus, taking 61,000,000 of acres suitable for cultivation:—

"If about one-half of the area were farmed on the four-course system it would give annually about 20,000,000 acres of grain, 10,000,000 of green crops, and 10,000,000 acres of clover. If the portion under grain produced only three quarters per acre, and that one-sixth were deducted for seed, it would leave 50,000,000 qrs. for the support of a population of 30,000,000. We should thus be independent of foreign countries for our supply of grain.

"Then as to meat. If each acre produced 20 tons of green crops, and that each ton of turnips yields 14lbs. of meat, then the green crops would produce 2,800,000,000lbs. of meat, or at the rate of 90lbs. for each person, being three times as much as is now consumed. This would leave 10,000,000 acres of clover, 21,000,000 of arable pasture land, and 16,000,000 acres of waste land for rearing cattle and sheep and producing milk and butter."

A consummation devoutly to be wished for, but, during the next few generations, it is somewhat doubtful as to where the capital would come from. We may, it is true, slowly improve our meat production, but simultaneously our increasing requirements will grow at a quicker pace.

Turning to our neighbours for assistance will do but little good, I fear, as long as the present system of transit arrangements and packing continues. Moreover, there are not too many who can afford to send us meat at all sufficiently near at hand to do so at a moderate cost. In the following Table I have given what I

TABLE

SHOWING THE AREA AND POPULATION (ACCORDING TO THE RESPECTIVE LAST RETURNS) AND THE NUMBER OF LIVE STOCK (W. L. SCOTT, SPECIAL ESTIMATES FOR 1868) IN THE CHIEF COUNTRIES OF THE WORLD.

| | Name of country. | Total area. English sq. miles. | Population. | Cattle. | Sheep. | Swine. | Goats. |
|---------------------------|----------------------------------|--------------------------------|-------------|------------------|-------------|------------|-----------|
| COUNTRIES EXPORTING MEAT. | Australia | 2,449,596 | 1,268,400 | 185,000,000 | 290,000,000 | ... | ... |
| | Canada | 346,860 | 2,507,657 | ... | ... | 4,940,000 | ... |
| | Argentine Republic | 800,000 | 1,171,800 | 17,492,000 | 72,319,000 | 260,200 | 1,482,280 |
| | Uruguay | Information conflicting | 342,000 | 13,084,500 | 8,879,000 | 248,900 | 32,680 |
| | Other South American States..... | | | | | | |
| | United States | ... | ... | about 27,000,000 | (?) | (?) | (?) |
| | Russia | 7,612,874 | 73,992,373 | 16,250,000 | 40,500,000 | 14,700,000 | ... |
| | Prussia and other States | 137,066 | 22,763,198 | 26,000,000 | 47,700,000 | 13,400,000 | ... |
| | Austria | 238,148 | 31,865,000 | 14,560,000 | 25,600,000 | 5,900,000 | ... |
| | France | 207,480 | 37,472,732 | 11,750,000 | 17,850,000 | 8,650,000 | 270,000 |
| COUNTRIES IMPORTING MEAT. | Denmark | 14,790 | 1,600,551 | 15,200,000 | 41,250,000 | 6,740,000 | ... |
| | Turkey* | 189,920 | 15,500,000 | 1,800,000 | 2,880,000 | 675,000 | ... |
| | Netherlands | 13,464 | 3,667,866 | 9,750,000 | † | † | † |
| | Belgium | 11,267 | 4,836,700 | 1,392,000 | 1,180,900 | 321,500 | 137,000 |
| | Norway | 121,779 | 1,600,000 | 1,420,000 | 590,000 | 447,000 | 210,000 |
| | Italy | 98,154 | 21,921,000 | † | † | † | † |
| | Great Britain | 122,823 | 30,152,000 | 3,940,000 | 11,100,000 | 4,330,000 | 900,000 |
| | Sweden | 168,042 | 4,022,580 | 9,300,000 | 34,560,000 | 4,940,000 | 2,500 |
| | Spain | 190,325 | 15,658,500 | 2,645,000 | 2,150,000 | 630,000 | ... |
| | Portugal | 36,310 | 4,035,350 | 3,750,000 | 23,940,000 | 4,620,000 | ... |
| | Switzerland | 15,540 | 2,534,242 | 1,200,000 | † | † | † |
| | | | | 1,150,000 | 573,000 | 341,500 | 372,000 |

* Turkey in Europe only.

† Not received in time.

believe to be the most accurate and comprehensive view of the live stock existing in the principal countries, which has yet appeared.^b It may, perhaps prove useful in the after-consideration of our subject, but time will not permit a dissertation upon it in detail. On comparing the British imports of live stock during

the last few years^c we do not find anything particularly encouraging, and on referring to the statistics of the coun-

^c The imports of animals into the United Kingdom since 1861 were as under:—

| | Cattle. | Sheep & Lambs. | Pigs. |
|-------|---------|----------------|---------|
| 1862. | 97,887 | 299,472 | 18,162 |
| 1863. | 121,483 | 338,415 | 27,137 |
| 1864. | 119,174 | 353,100 | ... |
| 1865. | ... | 713,084 | ... |
| 1866. | 223,216 | 762,620 | 117,083 |
| 1867. | 171,238 | 504,514 | 45,566 |

^a "Where shall we get Meat?" By Joseph Fisher. London: Longmans and Co. A treatise containing much valuable information, but a little inconveniently arranged, and not furnished with an Index.

^b Compiled expressly for "The Food Resources of the British Empire."

TABLE
SHEWING NUMBER OF ANIMALS IN THE COUNTRIES WATERED BY THE RIO DE LA PLATA, AND ITS TRIBUTARIES.

| NAME OF STATE. | NAME OF PROVINCE. | ESTIMATED NUMBER OF ANIMALS IN 1865. (<i>Extracted from "The River Plate as a Field for Emigration."</i>) | | | | | | | ESTIMATED NUMBER OF ANIMALS, 1867-8. (<i>Computed especially for the Author.</i>) | | | | |
|---|--|--|------------|---------|---------|-----------|---------|---------|--|------------|---------|---------------|--------------------------|
| | | Cattle. | Sheep. | Swine. | Goats. | Horses. | Mules. | Asses. | Cattle. | Sheep. | Swine. | Goats. | Horses, Mules and Asses. |
| ARGENTINE REPUBLIC. | Buenos Ayres | 6,500,000 | 50,000,000 | 115,000 | 5,000 | 1,800,000 | 25,000 | 5,000 | 7,470,000 | 58,600,000 | 122,000 | 4,700 | 2,310,000 |
| | Entre Rios | 2,500,000 | 6,000,000 | ... | ... | 600,000 | 7,000 | 500 | 3,150,000 | 5,815,000 | 6,700 | 1,880 | 826,000 |
| | Cordoba | ... | ... | ... | ... | ... | ... | ... | 1,880,000 | 3,110,000 | 1,600 | 700 | 194,000 |
| | Corrientes | 2,000,000 | 1,000,000 | 4,500 | 10,000 | 375,000 | 25,000 | 35,000 | 2,650,000 | 2,040,000 | 2,200 | 11,000 | 490,000 |
| | Catamarca | 185,000 | 80,000 | 2,500 | 121,000 | 40,000 | 15,000 | 25,000 | 300,000 | 132,000 | 2,150 | 105,000 | 122,000 |
| | Mendoza | 210,000 | 230,000 | 8,500 | 70,000 | 71,000 | 5,000 | 2,500 | 282,000 | 345,000 | 8,500 | 83,000 | 90,000 |
| | Salta | 255,000 | 150,000 | 2,500 | 95,000 | 50,000 | 15,000 | 34,000 | 400,000 | 321,000 | 2,200 | 116,000 | 198,000 |
| | San Luis | 31,000 | 160,000 | ... | 285,000 | 96,000 | 5,000 | 8,600 | 52,000 | 134,000 | 2,150 | 317,000 | 145,000 |
| | Santiago | ... | ... | ... | ... | ... | ... | ... | 45,000 | 240,000 | 3,200 | 250,000 | 812,000 |
| | Tucuman | 275,000 | 90,000 | 30,000 | 25,000 | 85,000 | 12,000 | 10,000 | 362,000 | 282,000 | 34,500 | 258,000 | 120,000 |
| ARGENTINE REPUBLIC. | Other Provinces, } Pampas, &c. } | ... | ... | ... | ... | ... | ... | ... | 900,000 | 1,300,000 | 75,000 | 335,000 | 3,400,000 |
| | Total Argentine Republic | 12,256,000 | 57,710,000 | 163,000 | 611,000 | 3,117,000 | 109,000 | 120,600 | 17,492,000 | 72,319,000 | 260,200 | 1,482,280 | 8,147,000 |
| REPUBLIC OF URUGUAY OR BANDA ORIENTAL. | Monte Video | 4,000 | 2,000 | 6,000 | 500 | 3,000 | 1,000 | ... | 14,500 | 11,000 | 7,800 | 950 | 9,800 |
| | Florida | 900,000 | 1,200,000 | 15,000 | 700 | 130,000 | 6,000 | ... | 1,470,000 | 2,780,000 | 22,000 | 1,100 | 215,000 |
| | Canelones | 500,000 | 80,000 | 16,000 | 500 | 10,000 | 1,800 | ... | 170,000 | 230,000 | 15,000 | 650 | 20,800 |
| | San José | 520,000 | 330,000 | 21,000 | 1,500 | 50,000 | 8,400 | ... | 785,000 | 630,000 | 40,000 | 2,700 | 84,000 |
| | Colonia | 410,000 | 500,000 | 5,400 | 2,000 | 130,000 | 3,000 | ... | 710,000 | 880,000 | 5,000 | 3,000 | 148,000 |
| | Maldonado | 503,000 | 50,000 | 5,000 | 600 | 70,000 | 3,000 | ... | 678,000 | 270,000 | 6,800 | 900 | 95,000 |
| | Salto | 756,000 | 300,000 | 12,000 | 4,000 | 330,000 | 14,000 | ... | 1,000,000 | 415,000 | 14,000 | 5,200 | 390,000 |
| | Tacuarembó | 1,500,000 | 12,000 | 10,000 | 600 | 125,000 | 58,000 | ... | 2,350,000 | 43,000 | 17,000 | 1,100 | 274,000 |
| | Soriano | 506,000 | 700,000 | 13,500 | 1,800 | 114,000 | 6,000 | ... | 497,000 | 850,000 | 18,000 | 3,100 | 181,000 |
| | Durazno | 500,000 | 70,000 | 1,300 | 500 | 45,000 | 1,800 | ... | 655,000 | 114,000 | 2,700 | 950 | 62,000 |
| REPUBLIC OF PARAGUAY. | Paysandú | 750,000 | 214,000 | 14,000 | 2,700 | 60,000 | 6,600 | ... | 1,200,000 | 415,000 | 18,000 | 3,100 | 82,000 |
| | Cerro Largo | 1,300,000 | 120,000 | 2,000 | 600 | 300,000 | 4,000 | ... | 2,410,000 | 270,000 | 4,100 | 730 | 486,000 |
| | Minas | 400,000 | 40,000 | 5,000 | 2,000 | 90,000 | 3,000 | ... | 384,000 | 83,000 | 21,000 | 3,200 | 151,000 |
| | Various, not be- } fore mentioned } | ... | ... | ... | ... | ... | ... | ... | 760,000 | 1,100,000 | 20,000 | 6,000 | 220,000 |
| | Total Republic of Uruguay | 8,096,000 | 3,618,000 | 126,200 | 18,500 | 1,457,000 | 116,600 | ... | 13,084,500 | 8,879,000 | 248,900 | 32,680 | 2,318,600 |
| | Empire of Brazil* | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | Republic of Para- } guay† | ... | ... | ... | ... | ... | ... | ... | 15,800,000 | 23,000,000 | 315,000 | not received. | not received. |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

* The Returns and Estimates for Brazil not received in time.

† Detailed accounts not yet received.

tries who send us the animals, there appears to be more symptoms of a diminished than of an increased supply for the future. The cattle-plague, and the necessary restrictions its ravages have called forth, have doubtless exercised exceptional influences, which, however, are now passing away, but if Norway, Belgium, and the Netherlands have, in point of fact, a deficiency of meat, rather than a surplus, it is plain that any we may obtain can only be brought here by the superior attraction of British gold, in other words, that it will be difficult to get cheap meat from those countries in quantities sufficient to produce any appreciable difference in the consumption of animal food here. Italy is not likely to be able to help either herself or anyone else for some time to come, but Prussia, Austria, and France may do good service, if on our part we turn our attention to transit and market arrangements both of which require strict supervision. In the first place, if foreign animals are to be imported at all, it is clearly our duty to provide for their health and comfort—on which the nutritive value of the flesh so entirely depends—in the best possible manner, which is certainly not done at present. I could multiply instances of the deaths and diseases among live stock, produced by stormy weather, in combination with arrangements which can only be likened to the “horrors of the middle passage” in the old slave-trade period; but as it is a bad plan to make statements which some people might think exaggerated while there is a chance of shifting the responsibility on to the shoulders of somebody else, I will simply give an extract from the paper of Mr. C. S. Read, M.P., delivered at the Central Farmers’ Club not long ago. After speaking of the preliminary sufferings of the bovine race, when packed—almost as closely as if they were already “salted down”—in the hold of the vessel, Mr. Read proceeded:—“Well, gentlemen, I can tell you what cattle suffer in a storm. It so happened, that in the autumn of 1863, while a very stiff gale was blowing off the east coast, though nothing like such a storm as we have had within the last day or two, there came two steamers, laden with cattle and sheep, into the port of Lowestoft. One of these vessels was the *City of Norwich*, the other was the *Tonning*. In the *City of Norwich* there had been 354 oxen, of which 179 were destroyed, and 460 sheep, of which 222 were dead; while out of 350 oxen in the *Tonning* 170 were destroyed. All the remaining animals were more or less injured and bruised. That case does not appear to be a very exceptional one. On taking up a number of the *Daily Telegraph* last October, this statement met my eye. In the *City of Norwich*, the same vessel that I have already mentioned, 7 sheep had just died on the voyage; in the *Troubadour* 24 sheep; in the *Taurus*, 2 oxen; in the *Swan*, from Bremen, 51 oxen and 20 sheep. It is added that one or two animals were constantly found suffocated on arrival or thrown overboard during the voyage. A little variety is given to these details by the fact that in January the *Moselle*, from Antwerp, had 20 calves frozen to death.”

This method of procedure in relation to our food supplies can hardly be considered one of the “means proposed for increasing them,” looking at the matter from an economic point of view, and leaving out the humane element entirely; and I hope that our discussion to-night will give due prominence to this portion of the subject, and that some valuable suggestions for the construction of cattle ships will be made.

Another drawback upon the importation of animals from abroad, is the danger of importing a host of diseases as well, besides making the cattle plague* chronic in this country. For this the remedies have been already proposed, and may be defined thus:—A thorough system of inspection, a moderate quarantine, and, lastly, the establishment of special “foreign cattle markets” at the chief ports of entry. As the only instance we need consider, to begin with, let us take Lon-

don. I have been at some pains to ascertain the main features of the existing state of things, and I can hardly conceive that, except where petty interests would endeavour to blindfold common sense, any opposition could be shown to the reforms so greatly needed.

As regards the position of the proposed market, various suggestions have been made, but although I have carefully and independently considered, upon their own merits, all that have been laid before me, I have no hesitation in giving the preference to the site proposed by Mr. James Odams, who, I hope, will give some detailed information respecting it to-night.

“The site in question consists of fifteen acres, situated on, and with six hundred feet of frontage to, the Thames, and with a like frontage to the Great Eastern Railway. It is within twenty-five minutes of the City, by either the Blackwall or the North Woolwich Railway; within ten minutes of Greenwich; within ten minutes of Woolwich; and within fifteen minutes of the Deptford Vic-tualling Yard.”*

Through the kindness of Mr. Odams, I have the pleasure of exhibiting a sketch of the site and its surroundings, which shows at a glance its general situation, and the transit advantages of the proposed plan, far better than I could describe them.

Under the most favourable circumstances, however, I think it must be admitted that the importation of live meat (if I may use the expression) will never increase sufficiently to supply the wants of our population, unless we go further off to obtain it, and this I am decidedly of opinion is simply impracticable. The difficulties, disadvantages, and expenses attending the shipment of animals, from short distances only, form a serious tax upon the result, and any extension of the sea voyage could only increase the catalogue of evils we have previously touched upon.

A foolish question was put to me last month, for it was—“Why cannot some chemist or other discover a means of producing meat, or the nutritious part of it, say from coal-tar or some refuse, and so do away with all killing of poor dumb animals?” A most humane idea, certainly, as well as an absurd one. It is true that essence of pine-apple, as fragrant as that extracted from the yellow fruit of the anana, can be obtained from crude potato-oil and rancid butter—I have a specimen here; that port wine which will deceive an importer can be manufactured in a moment by mixing this fluid with water; and that tartaric acid, quinine, and many other substances can be synthetically built up, but science is powerless to call into existence a single particle of organized matter, unless aided by the wondrous principle of life. As we cannot hope, then, to manufacture meat, where from, and how shall we obtain it? In the upper part of the table (page 259), already referred to, we see evidences of the presence in other lands of vast stores of animal food, a fraction of which, were it only here, would strengthen our people, diminish our poor-rates, and almost make the East of London happy. The entire question now concentrates into one sentence—how is meat, or any similar product, to be prevented from undergoing that curious change we call putrefaction? According to the records of the Patent Office, it would appear that nothing could possibly be easier—in fact, that there are several hundred ways of doing the thing; but, unluckily, in the great majority of instances, patent specifications are of about the same value as their waxen seals, a very moderate percentage of them being of any real utility, while they have not brought us any meat worth speaking of up to the present time.

It would take an entire session of this Society to describe at length the various processes for the preservation of food which have been suggested from time to time, but there are several which are, in my opinion, likely to prove of very great utility, and one which appears to

* The last outbreak of which has caused about 140,000,000 lbs. of meat to be lost for use as food.

• From “Why have a Foreign Cattle Market on the Thames?” By Jas. Odams.

possess all the necessary qualifications for increasing our supplies of animal food.

I have for some years past examined pretty narrowly into this branch of the inquiry, and I may venture to state that there are but few preservative processes I have not practically tested.

Thinking that such a concise review might be acceptable at this juncture, I have arranged in a table, at pp. 263 *et seq.*, the more prominent elements of the patent for preserving food that have been taken out in this country, from 1691 to 1855, in a convenient form for inspection and comparison. The principal points in more recent patents I have referred to in the body of the paper.

Before reviewing the various methods which have been brought forward for the preservation of animal food, it may be well to give a passing notice to the putrefactive fermentation itself.

Everybody knows that when a piece of meat (or other animal substance) is exposed to the air for any length of time, certain peculiar changes take place in its structure and appearance, which are familiarly described by the words, "souring off," "tainting," "going bad," and the like, while its nutritive powers become gradually impaired, and it acquires a fetid odour and a repulsive taste, which at last renders it totally unfit for human food. For a long time nothing more was known respecting the phenomena of putrefaction than that it was in a great measure an oxidizing process, resembling in some degree the behaviour of saccharine solutions under similar circumstances, but the cause of this was hardly hinted at, until the admirable researches of M. Pasteur. This distinguished savant showed that the putrefactive fermentation is induced or set up by the development of certain minute fungi, in the same way that the vinous fermentation is occasioned (or at least stated to be so) by the growth of the yeast-plant.* Then comes the question—Where do these little microscopic plants come from? a question which has caused very considerable discussion between those who believe in their spontaneous generation, and those who do not.

No organic body will undergo decomposition except there be a sufficiency of moisture and oxygen present for the development of these tiny organisms, together with a suitable temperature; take away any one of these three necessities, and no change will take place, while the presence of all three is incapable of determining putrefaction, unless some of the spores, or little seeds of the fungi we are referring to, are also at hand. These infinitesimal invisible particles are always present—in air and water even—ready to develop themselves at the first moment that the necessary conditions for their growth present themselves. At temperatures below about 34·5° Fahr. their vital germ seems dormant and unable to expand, while it appears to be entirely destroyed if exposed for a short time to an amount of heat represented by 320°. There are, however, some substances which have the property of taking away, or absorbing, these germs; among them are cotton wool and charcoal in various forms. I have in this tube some cotton (previously dried at about 280°) closely packed, and a current of air passed slowly through the tube no longer possesses, so to speak, any putrefying qualities, and with proper precautions some organic bodies can be kept unchanged in an atmosphere so prepared. Charcoal is even more effective, particularly the granular form† I have described elsewhere, and that prepared by the Silicated Carbon Filter Company at Battersea.

In practice it is simply impossible to exclude the minute cells or nuclei of vegetable life in an absolutely perfect manner, so the experiment is useless for commercial purposes.

The products of the decomposition of meat, &c., have not been very attentively studied, except, perhaps, by Dr.

Grace Calvert and myself. We have, however, no time for discussing them at present, as the various processes that have been brought out for the preservation of animal substances now claim our special attention. They may be best considered, I think, if we attempt a kind of rough arrangement, and divide them into the following classes:—

1st. The frigorific class, or those which take advantage of the fact that neither organic development nor putrefactive fermentation can really take place while the temperature is below or about the freezing point. To this division belong the methods of keeping meat, &c., in ice or freezing mixtures, the construction of ice-safes, &c. These are all necessarily of very limited application.

Upon some of the American railways currents of refrigerated air are employed for the purpose of keeping meat, &c., during its lengthened transit; but as far as I can learn no very large profits have resulted from this arrangement. Quite recently a plan has been proposed to import fresh meat from Australia into this country by means of iced chambers, so constructed that no portion of the ice shall come in contact with the meat. This scheme has already been noticed in the *Journal*, but I must confess, personally, my belief that it will fail, in the commercial sense, as many similar propositions have failed before. The meat, when it gets here, would, firstly, have cost too much; it would be excessively liable to decomposition on the removal of the cooling atmosphere, in the next place; and, lastly, I cannot help agreeing with Dr. Thomas Cattell, that its wholesomeness as an article of food would be seriously impaired.

If we take a piece of the fibrous portion of flesh, from which all the soluble matter has been removed, and divide it into three pieces, we have the means of observing the action of both heat and cold upon its structure by persistently freezing one portion for some days, boiling the second piece in water for a few hours, and examining the third microscopically, at the expiration of the requisite time. Upon submitting the two other portions of meat-fibre, or syntonine, to a similar magnifying power we shall find that they no longer compare with the original, but, nevertheless, very greatly resemble each other; that which has been boiled presents considerable structural contraction, toughness, and opacity, while the frozen specimen also exhibits, although in a less degree, perhaps, while both are rendered far more insoluble in dilute acids and alkalis. If we determine the nitrogen in each instance, also, we discover that a loss of this element has occurred, both in the boiled and frozen portions. From these facts, and from some others, I believe that frozen animal food cannot be considered nearly so nutritious as that in the ordinary condition, but I have no doubt that Dr. Cattell will give us some information upon this point.

Under the second head we may class the desiccating processes, which include all methods for robbing food products of their natural moisture to such an extent that there is not enough remaining to sustain the vitality of organic germs, or to permit the products of decomposition to remain in solution. To this valuable and important class belong the various modes of drying food products by means of heat, pressure, absorbents or centrifugal force. Many useful and ingenious processes have been founded upon this principle, and it is not too much to say that most people are indebted to it for a portion of their food nearly every day.

Messrs. Chollet's patent compressed vegetables combined with various meats, and an English patent, too, which preserves potatoes and other vegetables by forcing them while moist through small apertures in metallic plates and then drying the long threads thus produced, are good representatives of this class, as is also the so-called "flour of meat." All these have a certain limited sphere of usefulness, but are wanting both in cheapness and in nutritive power.

3rd. The enveloping class must comprise all those inventions which seek to prevent decomposition by placing

* *Mycoderma cervisiae*.

† British Pharmaceutical Conference, 1867. "On Granular Charcoal," by Wentworth L. Scott.

TABLE

SHewing THE VARIOUS PATENTS FOR THE PRESERVATION OF FOOD THAT HAVE BEEN TAKEN OUT IN GREAT BRITAIN FROM 1691 TO 1855 INCLUSIVE.

| Date. | No. | Name. | Object of Patent. | Method of effecting it. | Observations. |
|---------------|-------|--|---|--|--|
| 1691 Oct. 7 | 278 | Thomas Porter and John White | Preserving "flesh, fowle, and fish." | No description given. | |
| 1763 July 29 | 793 | Alexander Cockburn | Curing salmon with spices. | Boiling with cloves, mace, pepper, salt and vinegar. | Favourite method of preserving fish at the present day. |
| 1780 Dec. 30 | 1,275 | John Gracfer | Drying and preserving vegetables. | Boiling in brine, and then drying by sun, stove, or steam heat. | |
| 1791 Feb. 8 | 1,791 | William Jayne | Preserving eggs. | Submersion in mixture of lime, salt, and cream of tartar in water. | |
| 1793 Feb. 19 | 1,933 | John Donaldson | Preserving animal and vegetable substances. | Additions of farina or mucilage, and drying. | Of little practical value. |
| 1800 Sept. 11 | 2,441 | Benjamin Batley.... | Curing and preserving herrings and sprats. | Gutting the fish, and salting with "bay-salt, saltpetre and molasses," afterwards packing in casks with additional "pickle." | The foundation of the present system of salting and curing fish. |
| 1801 Jan. 20 | 2,465 | Do. do. | Curing and preserving other fish. | Do. do. do. | Do. do. |
| 1807 June 13 | 3,061 | Francis Plowden | Preserving meat and other comestibles. | Covering or encrusting with "essence or extract of meat." | |
| 1810 Feb. 26 | 3,310 | Augustus de Heine.. | Preservation of food. | Placing in vessels furnished with valve, and exhausting the air. | Vacuum processes exploded, from difficulty of perfectly excluding air. |
| Aug. 25 | 3,372 | Peter Durand | Preserving animal and vegetable food. | Putting in closed vessels, and afterwards heating the same. | Does not effect the object proposed. |
| 1812 July 16 | 3,585 | James Walker | Preserving food and other substances. | Making tubes of "tough and flexible metal," for enclosing the substances referred to. | |
| 1817 Aug. 5 | 4,150 | Ludvig Granholm .. | Preserving animal and vegetable products. | Pouring in hot fluid, jelly, and melted fats, to exclude air from containing vessels. | Or coating joints with suet and storing in brine. |
| 1819 Mar. 23 | 4,360 | Æneas Morrison | Do. do. | Cooking the articles in vessels, which are closed air-tight during the operation. | Gave the hint for all the other "provisions in tins" of the present day. |
| 1820 June 20 | 4,480 | John Vallance | Preserving hops. | Packing in metal or wood cases under hydraulic pressure. | Has not been generally adopted. |
| 1825 April 23 | 5,156 | Thos. Alex. Roberts | Preserving potatoes and other vegetables. | Cutting or otherwise destroying the "eyes or germs." | Of no practical utility. |
| 1827 July 12 | 5,523 | Robert Vazie | Preserving preparation of corn. | Various contrivances for protecting wheat and grinding corn. | The "conical" arrangement of flour mills probably founded upon this patent. |
| 1828 Jan. 31 | 5,614 | Donald Currie | Preserving grain and other substances. | Enclosing in air-tight vessels, exhausting and replacing the air with carbonic acid. | Precisely the same as the "new invention" of M. Lohel. |
| 1833 June 1 | 6,432 | Pierre Antoine Angilbert | Preserving meat and vegetables. | Patent relating to methods of rendering vessels air-tight. | |
| 1834 Nov. 13 | 6,711 | Daniell Rutter Long | Preserving carcases. | Injecting "antiputrescent" preparations into the blood-vessels. | The foundation of a series of "injection processes." |
| 1835 Mar. 11 | 6,787 | William Newton | Preserving "animal milk." | Adding sugar, and evaporating to a paste or dry cake. | Useful in a limited way.—product of unpleasant flavour. |
| 1836 Mar. 21 | 7,036 | Louis Elizee Scignette | Preserving meat, fish, &c., for navy use. | Exhausting the air, or extraction of its oxygen, &c. | Not now in use—too complicated. |
| 1839 June 20 | 8,117 | John Wertheimer .. | Preserving animal and vegetable substances. | No specification enrolled. | |
| 1840 Feb. 8 | 8,378 | Do. do. .. | Do. do. do. | Heating in cases with "one or two small holes," a special burner being used for closing the apertures. | The "burner for excluding air" afterwards disclaimed. Founded on an erroneous supposition. |
| Aug. 8 | 8,597 | Downes Edwards..... | Improvements in preserving potatoes and other vegetable substances. | Potatoes cooked, peeled, and forced through small holes in a cylinder by means of a piston, and the "threads" so formed dried. | Disclaimed as regards "other vegetable substances." |
| Oct. 13 | 8,658 | Charles Payne | Salting animal matters. | Forcing brine to penetrate by means of an air-pump. | Effective, although seldom used now. |
| Nov. 25 | 8,717 | Charles Grellet | New modes of treating potatoes. | Cooking potatoes and then reducing to dry meal, cakes, &c. | Not so valuable as No. 8,597. |
| 1841 Jan. 6 | 8,776 | Henry Gunter | Preserving animal and vegetable substances. | Cooking in tin cases with minute aperture, which is ultimately closed by a drop of solder. | Similar in principle to a number of others. |
| Mar. 8 | 8,873 | Stephan Goldner | Do. do. do. | Both these patents are similar to Nos. 8,378 and 8,776, but claim a "chemical bath" of "nitrate of soda or nitrate of lime" for heating the tins. | |
| Mar. 8 | 8,874 | John Wertheimer .. | Do. do. do. | | |
| 1842 Jan. 27 | 9,240 | { Henry Benjamin Henry Grafton... } | Preserving animal and vegetable matters by freezing. | Use of a mixture of ice and salt, or other freezing mixture. | Specially applicable to the preservation of fish. |
| April 6 | 9,312 | John Bevan | Preserving articles of food. | Application of a vacuum chamber in connection with vessels containing the articles to be preserved, concentrated solution of gelatine being then allowed to replace the air. | Effective when perfectly carried out, but too costly for general use. |
| Aug. 3 | 9,435 | Samuel Carson | Preserving meat or animal substances. | Use of injection, exhaustion, constant or intermittent pressure, or centrifugal force for causing "pickling or preservative liquids to permeate" | Many of the patentee's claims previously patented. |
| Oct. 8 | 9,487 | Claude Edward Deutscher | Improvements in materials for cementing, &c. | Gums, resins, &c., dissolved in naphtha, oils, alcohol, turpentine, &c., may be used for preserving provisions by coating the containing vessels. | Exhibits no points of novelty except in minor details. |

| Date. | No. | Name. | Object of Patent. | Method of effecting it. | Observations. |
|--------------|--------|--|---|---|---|
| 1843 Mar. 24 | 9,677 | Alfred Hooper Nevill | Preparing lentils for food. | Separating husk, making "flour of lentils," with or without addition of curry powder. | A well-known and useful preparation, far preferable to the "Revallenta Arabica." |
| Dec. 5 | 9,970 | James Cooper | Improvements in apparatus, &c. | Constructing jars and other vessels for cooking and preserving. | |
| 1844 Mar. 28 | 10,126 | { Robert Davidson } { Wm. Symington } | Drying and hardening wood and vegetable substances. | Application of currents of heated air to the desiccation of "sugar, coffee, starch, wheat," and other vegetable products. | Extensively adopted with several modifications. |
| Sept. 19 | 10,332 | Michael Fitch | Producing and applying preservative substances. | Conducting the distillate from oak and other woods into solution of salt, sugar, saltpetre, &c. | Acts by virtue of the acetic and tarry products (kreosote, &c.); especially adapted for fish. |
| 1845 Jan. 28 | 10,496 | Wm. Trueman Yule | Drying animal and vegetable substances. | Use of dry air currents, and of fragments of chloride of calcium for keeping same dry. | Has been useful in a limited sense. |
| July 21 | 10,781 | John Ling | Constructing ice safes. | Double-casing with non-conducting material prevents the ice from melting too rapidly. | Largely adopted even at the present day. |
| Nov. 4 | 10,922 | Samuel Carson | Preserving eggs. | Packing eggs in cases, exhausting the air, and partly cooking. | Will not accomplish the object intended. |
| 1846 Mar. 5 | 11,120 | Robert Warrington ... | Preserving various substances. | Coating with condensed meat-gravies, gelatine, fats, or otherwise, or submerging in glycerine, treacle, oils, &c., &c. | Patent claims too comprehensive; the processes are simple and useful. |
| June 12 | 11,240 | Robert Rettle | Improvements in manufacturing fuel, and purifying, compressing, and extracting various substances and fluids. | Use of double box, the lower portion connected with exhausting apparatus, the upper with reservoir or liquid; may be employed for salting meat, &c. | Of no particular value as applied to food. |
| Sept. 17 | 11,372 | Wm. Edward Newton | Preserving fruit and vegetables. | Arrangement of an ice-house. | On same principle as J. Ling's safe. |
| Oct. 15 | 11,414 | William Palmer | Purifying and preserving fats. | Melting, straining, pressing, salting and packing in bladders. | No point of interest presented. |
| Oct. 17 | 11,420 | John Ryan | Preserving organic and other substances. | Carbonic acid, and other gases, acetic and pyroligneous acids, kreosote, &c. | Specification contains some curious absurdities. |
| 1847 May 6 | 11,691 | John Horsley | Preservation of meat. | Solution of acetate of ammonia, injection or soaking. | Although volatile, this preparation gives an unpleasant flavour in practice. |
| May 14 | 11,703 | Thomas Shipp Grimwade | Preserving milk. | Addition of nitre, evaporation in vacuo, and sealing the solid in air-tight bottles. | Costly, and of an unpleasant taste. |
| May 29 | 11,726 | Francis Bernard Boekaert | Do. do. | Addition of carbonate of soda, and heating to 212° in corked bottles. | Ineffective except for a few days. |
| Oct. 7 | 11,892 | Jules Jean Baptiste Martin de Lignac | Do. do. | Straining, evaporating at 186° F. to one-sixth of its bulk, sealing up product in tin vessels, and exposing to 210° for ten minutes. | A slight step onwards, but the milk is liable to deposit lumps of butter, and to acidity. |
| Nov. 6 | 11,947 | { Robert Davidson } { Wm. Symington } | Preservation of meat, vegetables, and other edible substances. | Improvement on former patent in certain details, and cutting meat in thin slices and drying until it ceases to lose weight, mixing eggs with flour or farina, and drying. | Undoubtedly useful, but in a limited sense only. |
| 1848 May 26 | 12,166 | Felix Hyacinthe Folliet Louis | Preserving milk. | Addition of sugar and evaporating to dryness. | Improved and worked for some years at Misson. |
| Aug. 21 | 12,250 | John Bethell | Preserving meat, corn, beer, wines, milk, &c. | Grain of all kinds is dried by superheated steam, meat is treated with brine, mixed with wood naphtha or pyroligneous acid, and then either dried at 176° F., or packed in casks with compressed carbonic gas, the liquids are secured in strong vessels and charged with "compressed carbonic acid." | Patent could not hold valid on all points, but possesses some interesting and useful details. |
| Dec. 21 | 12,381 | { John Trowis..... } { John M'Simes ... } | Packing lard, &c. | Packing in muslin or calico, coating with gelatine or starch paste, and lastly dipping into alum and salt. | Possesses several advantages over the usual bladder, which, however, it has not superseded. |
| 1849 Mar. 28 | 12,548 | John Britten..... | Various, including preservation of corn, &c. | Constructing apartments with perforations for forcing hot air through. | Similar to many other patents. |
| Nov. 17 | 12,850 | William Brindley .. | Various, including preservation of vegetable substances. | Placing between oiled papers, and stoving at 250° to 300°. | Simply impracticable as regards food. |
| 1850 Nov. 12 | 13,338 | Etienne Masson | Preserving vegetable substances. | Drying and compressing vegetables, &c., and sometimes grinding them to powder, peas and beans scalded and then dried. | Valuable, but superseded by more recent methods. |
| 1851 Jan. 30 | 13,447 | James Murdoch | Preserving animal and vegetable substances, &c. | Drying by hot air, and injecting with solution of nitre and the chlorides of sodium and aluminium. | Has proved no better than other injection patents. |
| July 3 | 13,680 | Charles Payne | Drying animal and vegetable substances, &c. | No special description given. | |
| Aug. 21 | 13,723 | James Robertson | Improvements in preparing printing dyes and albuminous extracts, &c. | Extracting meats by pressure, &c., evaporating extracts to dryness; may be mixed with farinas as for food. | An attempt at the <i>Extractum Carnis</i> of our own day. |
| Sept. 4 | 13,732 | Baron Chas. Wetterstedt | Preserving animal and vegetable substances. | Mixing with flour, and drying and enclosing in air-tight vessels. | This and the succeeding process somewhat resemble that of Dr. Hassall and others. |
| Sept. 5 | 13,741 | Gail Borden, Jun. ... | Preserving flesh, &c. | Meat is macerated (with steam) strained, mixed with flour, &c., and baked in form of biscuits. | Useful for home or expeditionary purposes. |
| Dec. 8 | 13,845 | Richard Archibald Brooman | Improvements in applying electro-chemical action for manufacturing purposes. | Forming an antiseptic compound in the meat itself; for oils and syrups acetate of magnesia is used. | Description thoroughly absurd and process ineffective. |

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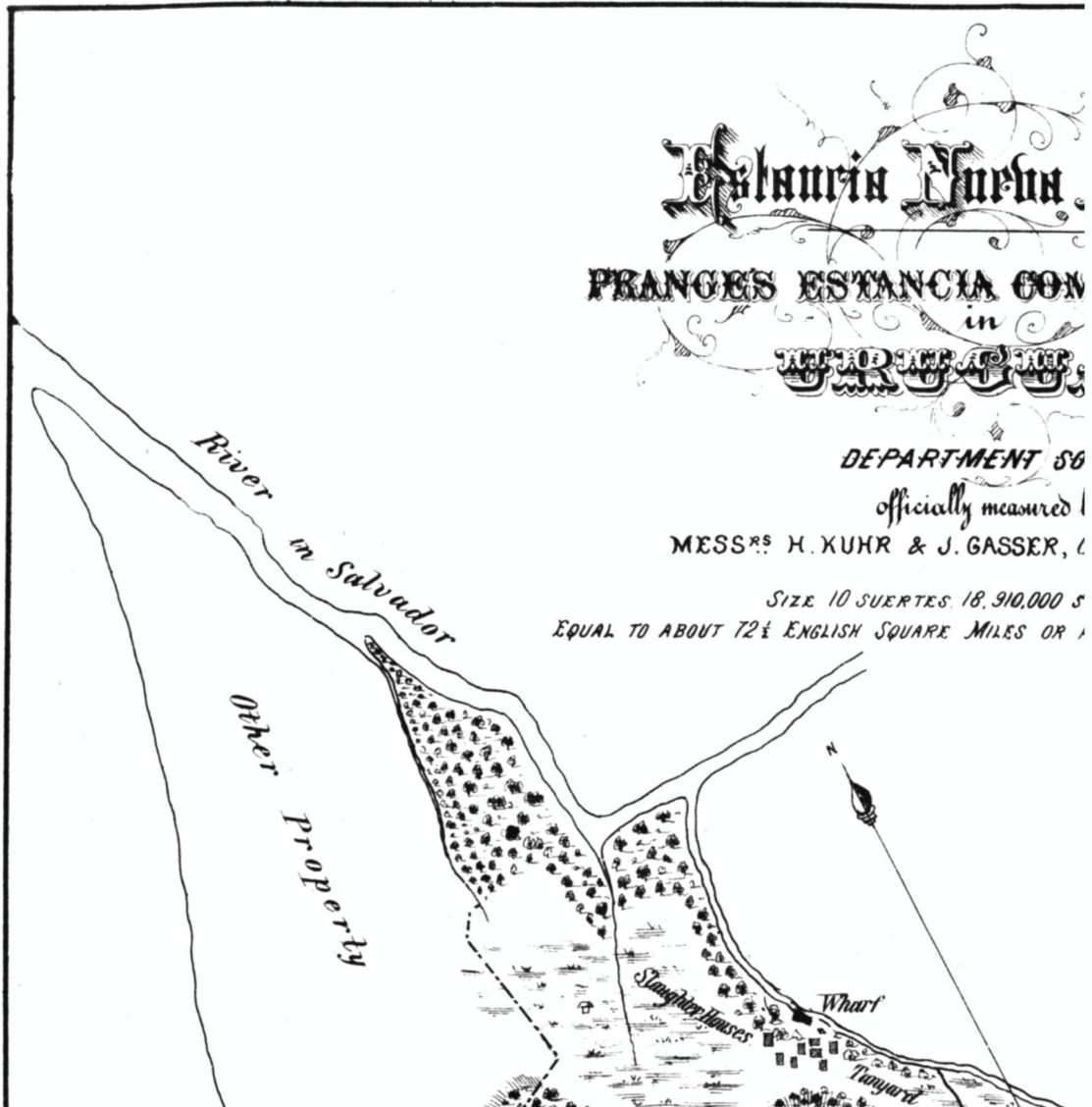
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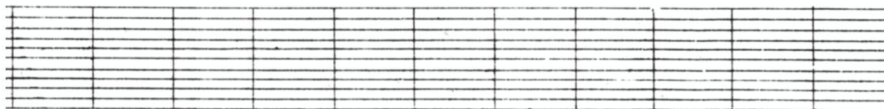
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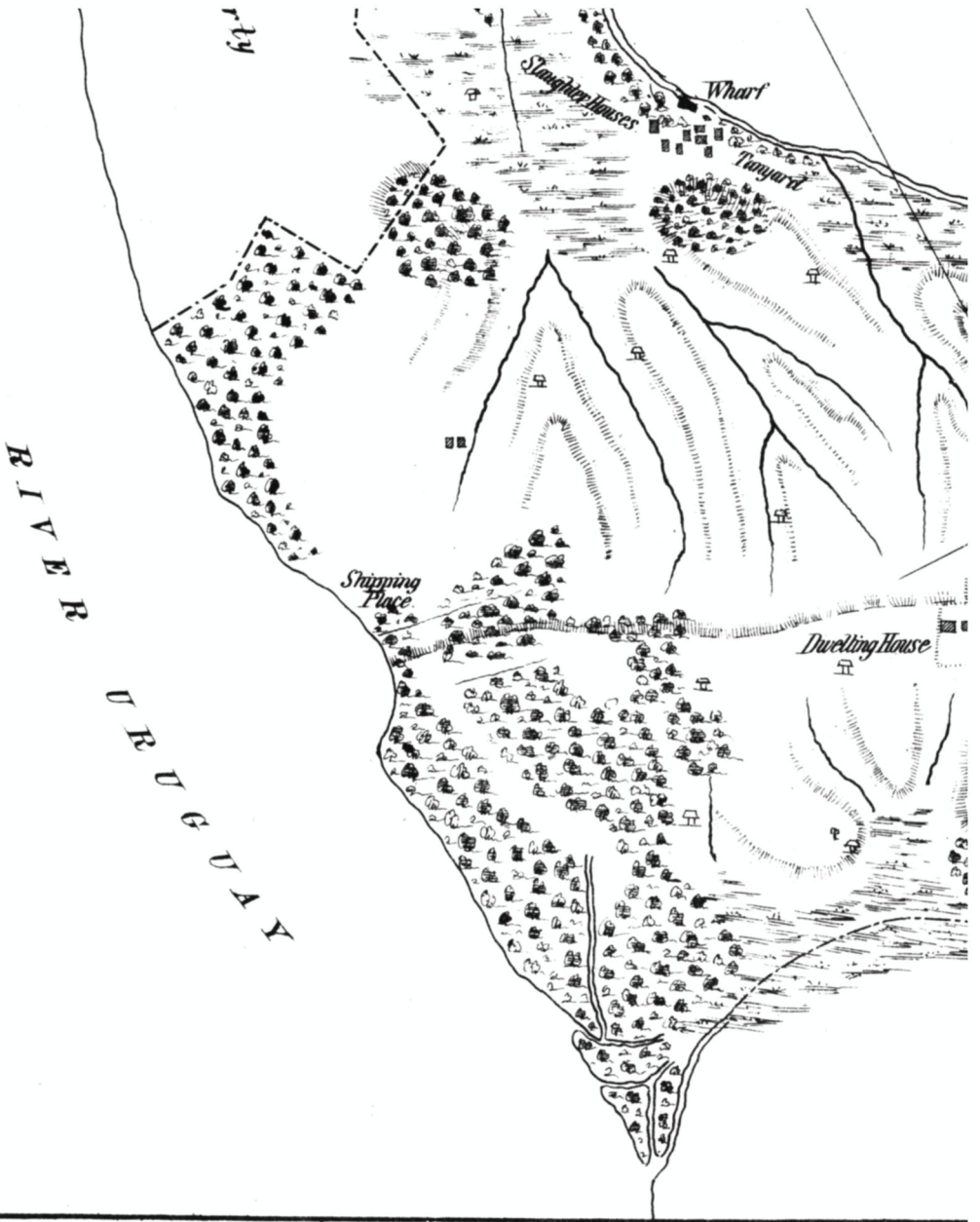
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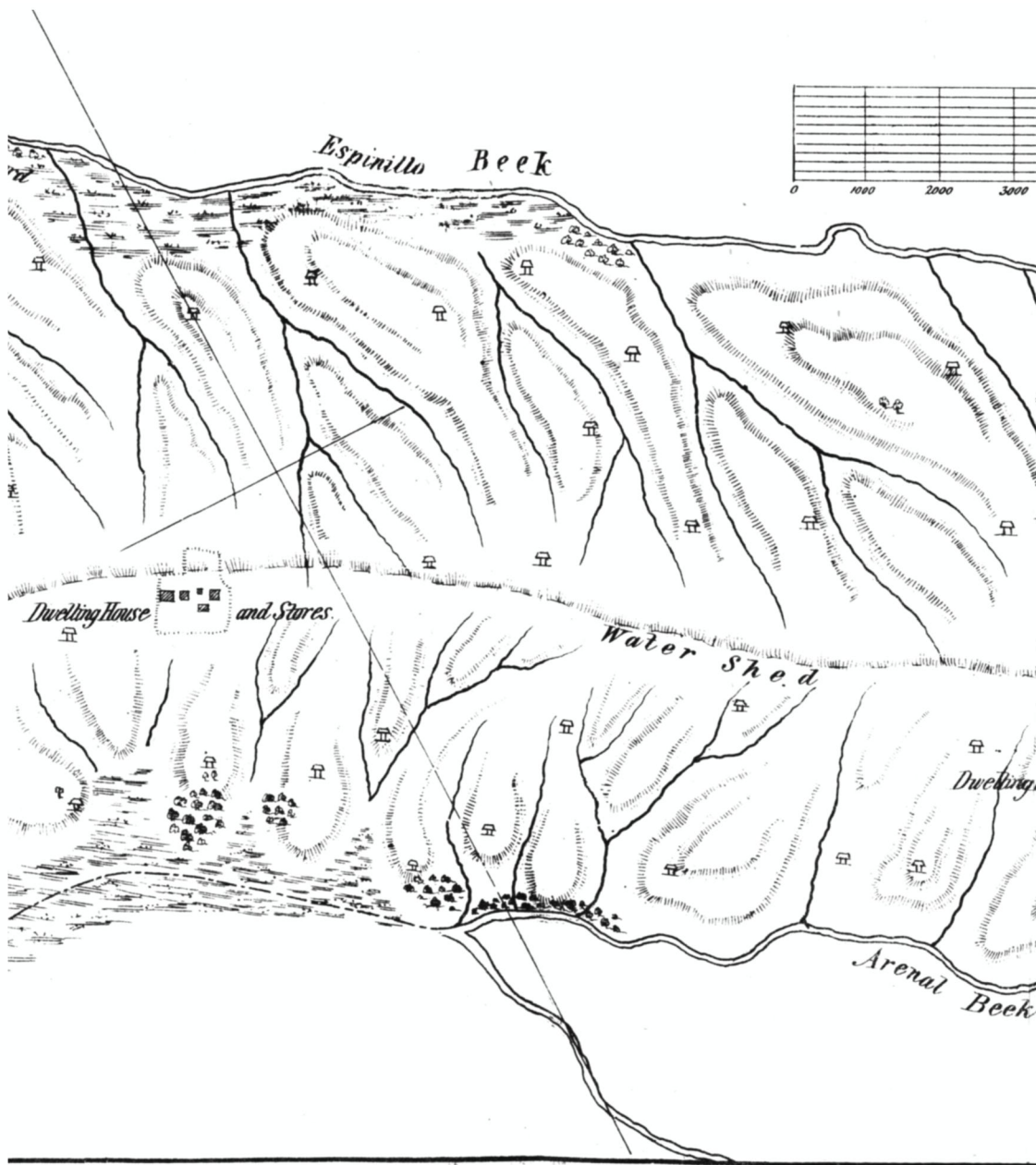
A sketch of a river section, labeled "Espinillo Beck". The sketch shows a winding river with several small islands or bends. The label "Espinillo Beck" is written in a cursive script above the river.

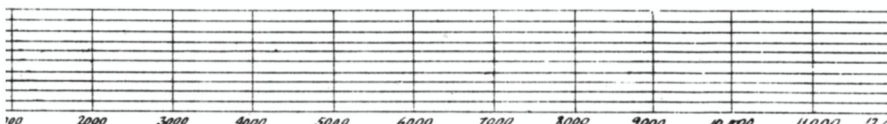
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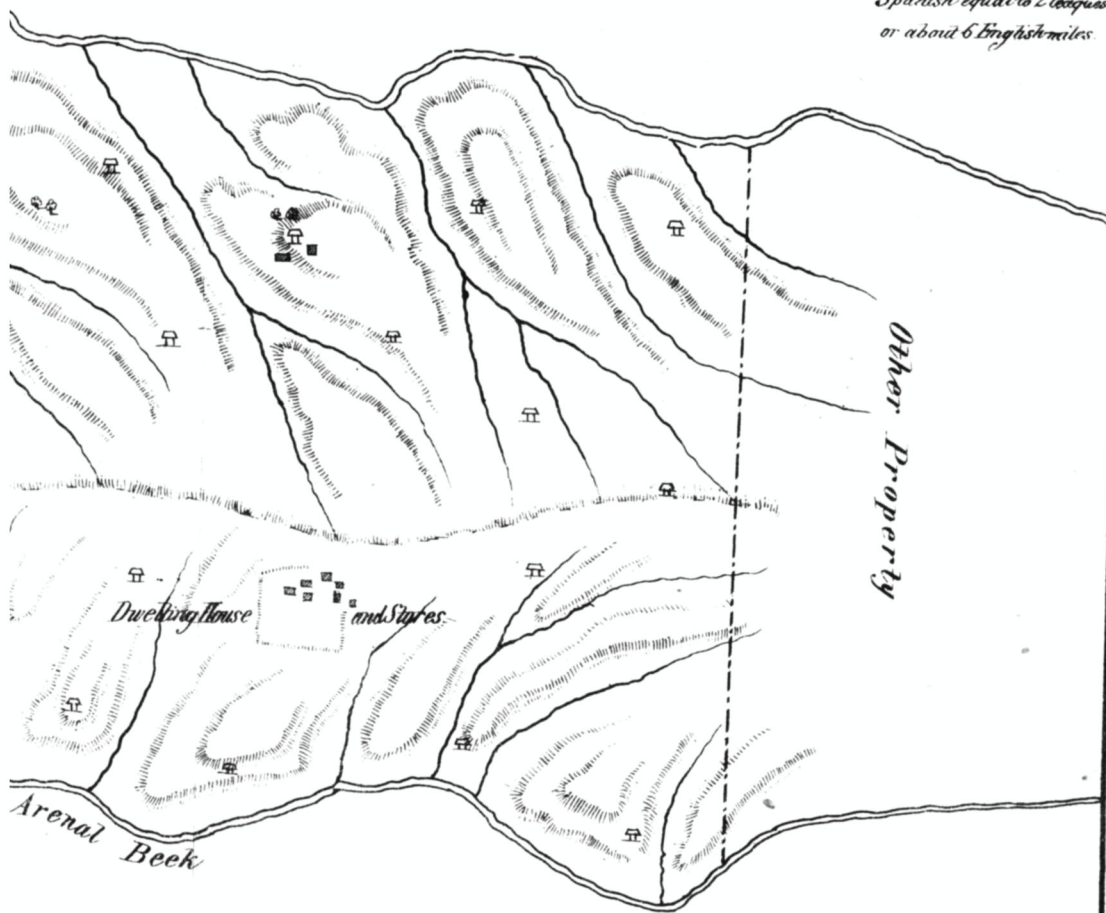








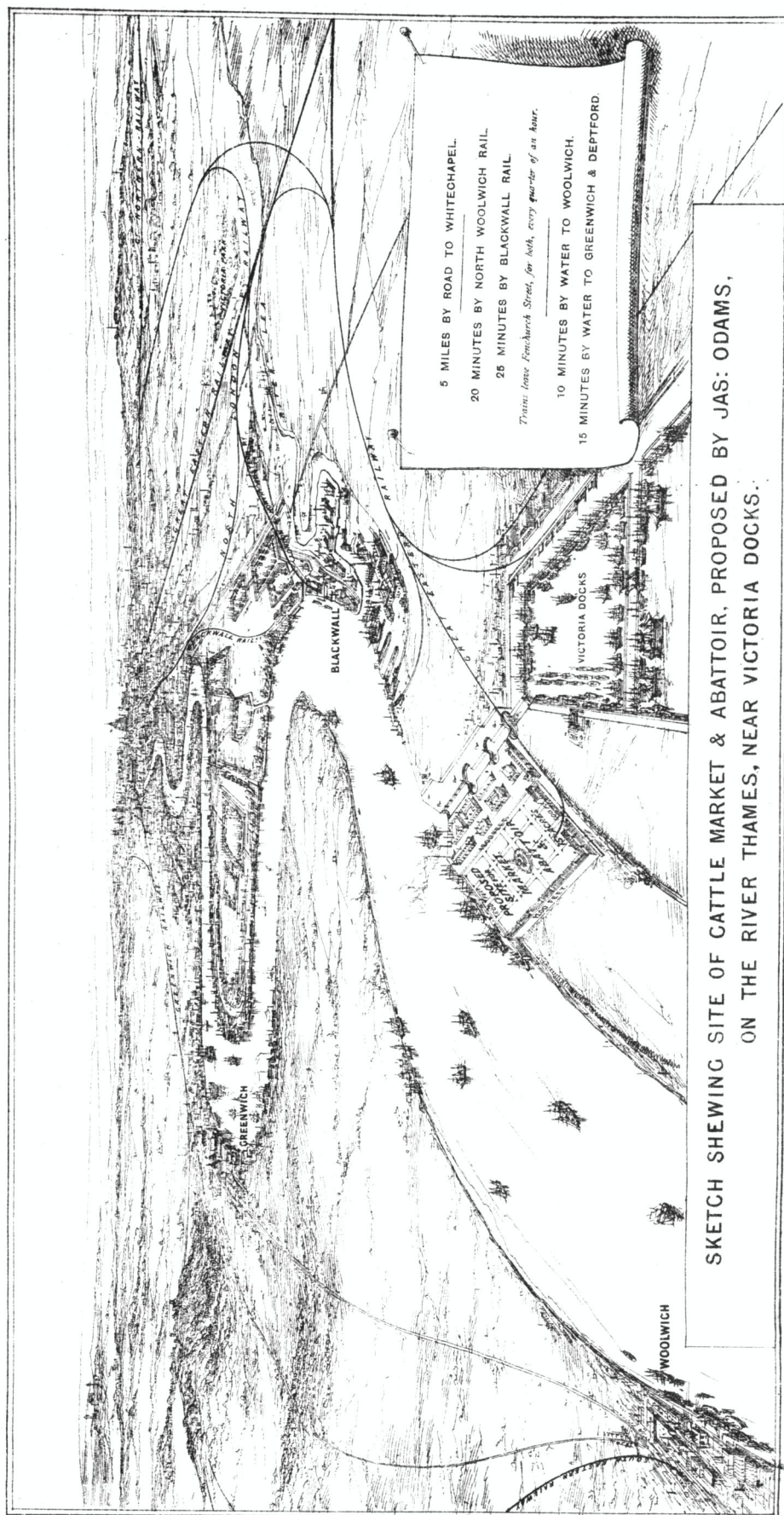
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"ON THE SUPPLY OF ANIMAL FOOD TO BRITAIN, AND THE MEANS PROPOSED FOR INCREASING IT."

BY WENTWORTH LASCELLES SCOTT,

F.C.S., F.A.S.I., F.R.S.A., ETC.



| Date. | No. | Name. | Object of Patent. | Method of effecting it. | Observations. |
|--------------|-------|---|--|---|--|
| 1852 Oct. 12 | 351 | Louis Constant Alexandre Vittraut | Preserving grain, seeds, &c. | Use of double chambers, warm air, and carbonic acid. | Useless and absurd. |
| Oct. 22 | 486 | Julien Boileve | Preserving vegetable substances, &c. | Revolving sieves, in air-tight chamber and condensing chlorine gas. | Practical as regards the destruction of insects only. |
| 1853 Jan. 15 | 106 | Chas. Hippolyte Vion | Various, including production of ice. | Production of food by saline freezing mixture. | |
| Jan. 31 | 246 | Chas. Cowper (a com.) | Preservation of butter, meat, fish, &c. | Use of carbonic acid gas evolved in any manner. | Has been patented over and over again. |
| Feb. 25 | 477 | William Symington | Preservation of milk, &c. | Putting up in air-tight vessels and exhausting the air. | Same principle as many others. |
| Mar. 2 | 520 | Alexis Soyer | Preparing and preserving soups. | Storing various meats, and sealing the concentrated gravy, &c., in bottles. | This is the celebrated "Osmazone Fool." |
| April 29 | 1,041 | Thomas Collins Bousfield | Cutting and chopping vegetable substances. | Use of revolving blades for cutting and preserving roots, &c. | No point of novelty or interest. |
| April 29 | 1,042 | Do. do. | Drying and preserving vegetables and plants. | Exposing in chambers heated by grates and flues. | |
| June 10 | 1,418 | Henry Ed. Symons... | Improvements in preserving meat. | Forcing refrigerated air-currents over meat by fans, &c. | This invention, now public property, is on the same principle as that recently proposed by Mr. Moit for importing meat from Australia. |
| June 13 | 1,448 | Alexander Robertson | Improvements in vessels for storing edibles. | Chambers with air-tight doors or valves, and exhaustion. | |
| June 16 | 1,467 | Peter Armand de Fontaine Moreau | Preserved milk and other substances. | Forming a vacuum in containing vessels by usual means. | Covered by previous patents. |
| Sept. 24 | 2,205 | William Farmer | Preserving provisions. | Use of double vessels, outer one to contain water. | Both useless and absurd. |
| Oct. 5 | 2,278 | Henry Stevens | Preparing and preserving vegetable substances. | Steaming, mashing, and drying in warm air. | Covered by previous patents, <i>e.g.</i> , 8,697, Aug. 8, A.D. 1840. |
| Oct. 12 | 2,348 | Charles Scott Jackson | Preserving seeds, roots, &c., from mildew, &c. | Use of soluble zinc-salts, principally the sulphate. | Useful in preparing potatoes for seed. |
| 1854 Jan. 31 | 231 | { Arnold Morel } { Fatio | Preserving animal and vegetable substances. | Cooking by steam, and afterwards drying in stoves or in "a vacuum apparatus." | General want of novelty. |
| Mar. 9 | 570 | { Francois Verdeil } Hippolyte Launy ... | Do. do. do. | Introduction of sulphurous acid gas into containing vessel. | This and succeeding one make "sulphurous acid gas" public property. |
| July 12 | 1,534 | Auguste Edouard Goradoux Bellford | Improvements in preserving animal substances. | Solution of sulphurous acid of gas with $\frac{1}{10}$ of hydrochloride acid; sealed corks. | |
| July 21 | 1,600 | { Toussaint Dela- } { boure | Preservation of meat in natural state. | Drying by machine similar to the "linen-drying machine," coating with concentrated gelatine and drying. | |
| Aug. 5 | 1,719 | { Leon Bonnet ... } | | | |
| Aug. 26 | 1,874 | Charles Frederick Stansbury (a com.) | Improvements in air-tight vessels. | Forming annular groove near top, and excluding air. | Superseded by the caoutchouc ring. |
| | | Correntin Marie Peronne Kerwood | Preserving meat, &c. | Partly cooking, soaking in vinegar and salt, and sealing in tins. | No point of novelty. |
| Oct. 20 | 2,242 | { Louis Auguste } { Chem } | Do. do. do. | Scalding, dipping in solution of sal-ammoniac, and drying in stove at 138° F. | Of no practical utility. |
| | | { Francois Fredk. } { Pillias } | | | |
| Dec. 7 | 2,572 | { Ferdinand Cellier } { Blumenthal ... } | Do. do. do. | Various claims, including drying by hot air or vacuum, powdering, and redrying; also forming "meat tablets," or by pressure, and afterwards cutting them. | Carried on on large scale—very valuable for army, navy, and expeditionary purposes. |
| 1855 Jan. 6 | 36 | { Maximilian Louis } { Toussaint Dela- } | Preserving meat, poultry, bread, eggs, vegetables, and pastry. | Coating with a "preserving varnish," obtained by boiling them (gelatine) and exposing to a dry current of air. | Trenches upon the ground occupied by preceding, which is better. |
| Jan. 11 | 70 | { Angeline Bonnet } | | | |
| Jan. 13 | 95 | Louis Jacques Hevé | Preserving meat and fish. | Cutting in strips, and drying, first in stove then over oil of vitriol. | |
| Jan. 19 | 153 | Gustav Warnecke .. | Preserving fruit and vegetable substances. | Use of a "saline vapour bath" (!) washing, drying, and pressing. | A patent absurdity. |
| Feb. 5 | 269 | Matthew Boulton Rennie | Preserving animal and vegetable substances. | Coating with "gelatine and jelly, mixed with albumen and alcohol." | Similar to many former processes. |
| Feb. 20 | 375 | Ebenezer Hartnall .. | Do. do. do. | Coating, first with gelatine and treacle, then with same and charcoal powder | The double coating and use of charcoal powder a slight improvement. |
| Feb. 21 | 381 | Jean Wothley | Preserving meat. | "Dusting" with sugar and salt, pressing out juices, and packing in double casks, with melted fat in all interstices. | A costly, complex, and wasteful process. |
| Mar. 8 | 519 | George Nasmyth | Preserving animal and vegetable matters. | Use of volatile fluids* to expel air from recesses, which are afterwards sealed. | *Such as alcohol, ether, &c. |
| Mar. 29 | 695 | John Taylor | Preserving eggs, &c. | Placing in moulds or shapes, and filling with plaster of Paris. | Will not answer. |
| April 30 | 965 | Francois Joseph Auger | Preserving vegetable substances. | By means of "diastase," dipping in decoction of malt, and drying. | ineffective. |
| May 1 | 971 | Edward Acres | Dedicating and cooling air, &c. | Passing hot air over cold surfaces, to deposit its moisture thereon, and applying same to drying and preserving farina. | Object better accomplished by other means. |
| June 9 | 1,320 | James Torbitt | Preservation of a constituent of the potato. | Utilisation of the "fibrine" after extraction of starch. | The cellulose (not "fibrine") is useless for breadmaking as proposed. |
| July 12 | 1,559 | Masta Joscelin Cooke | Preserving meat, milk, vegetables, &c. | Boiling under pressure, pulping, thickening, and pressing into cakes, &c. | Inferior to Chollett's process. |
| July 16 | 1,590 | John Bethell | Preserving meat, fish, fruits, &c. | Drying at from 90° to 100° F. | No point of novelty. |
| July 18 | 1,608 | Wm. Henry Tayler.. | Improvements in sealing preserve canisters. | Screw-cap lid, with caoutchouc ring, and fusible cement. | |
| July 21 | 1,650 | Walter Christopher Thurga | Preserving the fluid part of eggs. | Beating up, spreading on trays, and drying at low temperature. | Useful; similar to Mr. C. Lamout's recent process. |
| July 21 | 1,651 | Alfred Tooth | Preserving and curing entire animals. | Injecting solution of saline substances. | The "Morgan" process is identical with this. |
| July 21 | 1,651 | George Henry Perry | Improvements in vessels or cases. | Screw-cap cover. | Very like Tayler's (see ante). |

| Date. | No. | Name. | Object of Patent. | Method of effecting them. | Observations. |
|-------------|-------|---|---|--|---|
| 1855 Aug. 7 | 1,788 | George Nasmyth | Preservation of food. | Use of carbonic acid gas, alone or with alcohol vapours. | |
| Aug. 25 | 1,923 | John Avery | Improvements in exhaust- ing and closing vessels. | Certain valve arrangements and exhausting pump. | |
| Sept. 19 | 2,116 | Richard Archibald Brooman | Preserving animal and vegetable substances. | Drying, exposing to sulphurous acid gas, and coating with albumen, with molasses, and decoction of molasses. | No novelty in any point except the mallow root, which is useless. |
| Oct. 4 | 2,223 | Francois Modeste Demait | Do. do. do. | Hanging in chamber with fire on which sulphur, chloride of lime, and "flowers or roots" is thrown. | Absurd, ineffective, and injurious. |
| Oct. 9 | 2,258 | Stephen Goldner | Improvements in apparatus for cooking and preserving. | Relating chiefly to arrangements for heating the metal cases, in trays, &c. | |
| Oct. 27 | 2,404 | Joseph Hands | Preserving animal and vegetable substances. | Nitrous and sulphurous acid gases, binoxide of nitrogen, separate or mixed. | Of no value whatever. |
| Oct. 30 | 2,422 | { Jules Jean Bap- tiste Sylvain... } | Preserving animal sub- stances. | Drying in hot air, compressing into boxes, filling interstices, soldering on lid, and heating. | Applicable chiefly to sardines, &c. |
| Oct. 31 | 2,430 | Thomas Shipp Grim- wade | Preserving milk. | Adding alkali and sugar, evaporating at 160° pressing and powdering. | In extensive use for many years, although covered by Louis's previous patent. |
| Dec. 11 | 2,800 | { René Simon Bouetttt | Preserving meat, &c. | Coating with collodion. | Costly, and effective for a short time only. |
| | | { Henri Emile Isi- dore Donein ... } | | | |

as it were a protecting shield or bulwark between the organic substance—such as meat—and the oxidizing influences of the atmosphere, and may be subdivided into "hermetically sealed provisions" in tins, canisters, bottles, or jars, and "encrusted" or covered-up articles. The former division has long, and, to a certain extent, favourably been known. It has answered specific purposes for military, naval, and exploring expeditions, but the objections to it are, that (in tin cases) it frequently imparts metallic flavour to the food, which it overheats, to the detriment of its nutritive power, and again it is too costly. In the second division will be found meats &c. preserved by being coated with a film of wax, paraffin, stearine, gelatine, gutta-percha, caoutchouc, xyloidine (collodion), &c., or kept covered with syrup, glycerine, oils, spirit, &c. The same objections, modified according to circumstances, likewise apply here, with the addition of others; the preservative coating, if broken at any point, however small, loses at once its protective powers. In illustration of this, I may mention that I made the experiment of inserting a small tube of platinum into a piece of lean beef, and immersed the latter in melted paraffin at 240° F.; upon taking out the meat, it was of course perfectly coated, and had no access to the air except through the narrow tube ($\frac{1}{32}$ in. diameter). In the course of a few days, however, decomposition set in from the point of insertion of the tube, and gradually extended; oxidation once set in at that point, it rapidly assumes the mastery over the whole. Many of these films, too, are, to a certain extent, permeable by, or porous to, gases, and are, therefore, not to be depended upon.

Of this class, I may point to the Redwood patent process as a representative of one division, and to the Australian "beef without bone," in tins, specimens of which are before you, as belonging to the other. In the list of patents (see Table, pp. 263, &c.), appended herewith, you will observe a great many which make tins, jars, or other vessels, which are sealed after expulsion of the air, their speciality, and that of Æneas Morrison (March 23, 1819) was probably the first patented process of this kind. The general method of procedure is now to place the meats, cut into small pieces, in tin canisters with a little water, the top plate or lid of the canisters being next soldered on, airtight, with the exception of a small aperture at the top. The tins of meat are then removed to a water bath—that is, are plunged, to about three-quarters of their height, into a solution of chloride of calcium, of such strength that the boiling point is about 280° Fah. The water in the tins of course boils at its usual temperature, 212°, and the steam thus generated rushes violently out through the little hole before men-

tioned, of course completely expelling the air. At the expiration of from 20 to 30 minutes a workman approaches the rows of canisters, with a ladleful of melted solder in one hand and a large sponge full of cold water in the other. He applies the latter to the small orifice, through which the steam is escaping, in such a manner that a slight condensation takes place, and then removing the sponge, allows a drop of solder to fall exactly upon, and completely close the aperture of the tins, which are instantly removed from the bath. Of the result of these operations there are several specimens before you.

The Redwood process consists in completely immersing the meat to be preserved in fluid paraffin, and allowing the same to remain for some time at a temperature of about 240°, 28 degrees above the boiling point of water; they are then removed, and on cooling are found to be coated all over with paraffin, and although the meat is, in my opinion, spoilt by the overcooking it receives, it will keep sweet for some little time while the waxy film remains intact. The process is, as may be seen readily, too troublesome and expensive for extensive use, while a slight abrasion of the surface, or even pin-prick, will suffice to lay bare a surface to the air, from which decomposition may set in very speedily. Quite recently the protective coating has been rendered somewhat more effective by the superposition of a layer of glycerine and gelatine.

4th. We may call this the deoxidizing class, which necessitates the addition of some chemical substance, solid, liquid, or gaseous, which having in itself a very great affinity for oxygen will rapidly absorb it, and thus prevent the meat or other substance from becoming oxydised. Various chemical compounds have been employed for this purpose, but their use is attended with danger of flavouring the food and of altering its chemical characters.

The fifth, or antiseptic class, includes those methods of food-preservation which depend upon the addition of some substance which, by a simple property known as catalysis, prevents or arrests oxidation or putrefaction by its mere presence, undergoing no change in itself, or but very little. To a greater or less extent salt, sugar, creosote, carbolic acid, ether, chloroform, essential oils, and various salts and gases, possess this property, and are constantly employed for the purpose, either separately or as mixtures. The numerous applications of "cured" or "salted" meats are well-known and appreciated, as the several forms of salt beef, salt pork, bacon, ham, tongues, bath chaps, salt fish, &c., abundantly testify. In the case of ham, bacon, tongues, &c., they are greatly improved if, after salting, they are submitted to the

influence of wood or peat smoke, during which process a minute quantity of acetic acid and creosote is absorbed, which imparts a peculiar but agreeable flavour, while it acts as a most powerful preservative. The presence of even a very small amount of creosote will entirely prevent putrefaction, while it has no great action beyond that of an astringent when taken internally.

In the long run, however, no one could live healthily on creosoted food, while the ordinary salting process robs meat of a too large proportion of its organic and mineral constituents, and renders the flesh itself hard and indigestible. Numerous modifications of the curing processes have been suggested, and one which has been patented several times over offers some advantages; it consists mainly in injecting brine into the veins and arteries of animals immediately after slaughtering them, the entire capillary system being thus quickly and effectively permeated with salt, thus avoiding the waste of the brine-tub process, which Dr. Marcet was at such pains to utilize. He found that a very large quantity of albumen, an important substance called kreatine, and other soluble principles, were always left behind in the liquor when meat was salted, and he endeavoured to recover them by a process called dialysis. The attempt was only partially successful, but it led to a valuable suggestion, viz., that meat, previous to salting, should be enclosed in a membrane of some kind, such as bladder or parchment-paper. By this simple plan much nutritive matter can be retained in the meat, which is cured quite as effectually.

In drysalting, various herbs, spices, &c., are often rubbed in with the powdered salt, as a means of varying the flavour. Tropical climates, however, test the powers of any preserving process, and accordingly we find that salting affords but little protection against the oxidising and fermentive powers of an Indian sun. In many parts of India and in some of the southern states of America, it is found necessary to modify the ordinary salting process, which is there conducted in this wise:—A hole is dug in the ground about five or six feet deep, and carefully lined with boards; in this the meat and salt are closely packed, and over all a layer of boards is placed afterwards, covered with earth or mud: this is the favourite system in South Carolina, where, according to Mr. H. Clark, meat is often kept thus for many weeks. An Italian process has been brought before the French Academy lately, in which the preservative composition is a mixture of alun and gum-benzoin, both powdered, in which the meat is laid. In the case of beef it was reported to answer, but the mutton was but imperfectly preserved.

Of the chemical antiseptics, there is at the present time but one which appears to possess the necessary qualifications for preserving meat cheaply, easily, effectively, and without either injuring the nutritive qualities or imparting an unpleasant flavour; I allude to that patent on which the process of Messrs. Medlock and Bailey (of which numerous illustrations are now before you) is founded—the bisulphite of calcium, or, as it is commonly rendered, the bisulphite of lime.

It is remarkable that sulphurous acid has frequently been employed alone for the preservation of meat, but has failed in all instances from its volatile nature, causing it to be dissipated too soon to be any real protection. The sulphites of sodium and potassium, in solution, have likewise been patented for the like purpose, but their unpleasant flavour, their action upon the meat itself, and the injurious nature of the purgative sulphates formed by their oxidation, have precluded their use in quantities calculated to influence the "food of the people" in any great degree; moreover, their antiseptic action is not so certain as that of the preparation I would specially introduce to your notice.

The neutral sulphite of lime is only slightly soluble in water, and its antiseptic properties are by no means so marked as those of the bisulphite, which contains double the amount of sulphurous acid, is perfectly

soluble, and, when oxydised, is merely converted into sulphate of lime—a substance perfectly harmless and inert.

In this preparation, I believe we have a means of converting to our use the enormous meat stores of Australia and South America, and I look forward with confidence to seeing beef and mutton imported for sale at 2½d. to 3d. per pound, of a quality equal to any we can now procure.

At page 260 is a Table, showing the number of animals in the various provinces of the Argentine Confederation and of Uruguay. The first supplies of meat from these countries we shall probably receive from the estancia, Nueva Allemagna, of Messrs. Prange, a plan of which, showing its convenient situation, and the fine irrigating land for breeding purposes, accompanies this paper.

I have prepared a number of specimens (now before you) with this solution; they have been preserved for periods varying from six weeks to as many months; and among them you will find some mutton treated under the immediate superintendence of the Food Committee of this Society in November last—some canvas-backed ducks, prairie-hens, clams, oysters, &c. (prepared by D. D. Williamson, Esq., at New York, about the middle of January), "lamb's sweetbread," treated with bisulphite on the 31st August last, which I exhibited at Dundee in September, 1867, and various other eatables.

I would also beg to draw your attention particularly to these samples of fish, contributed by Mr. Edward Acres, of Youghal, near Cork, as sufficiently demonstrating what could be done in this department. Mr. Acres, to whom I am indebted for a large amount of most important information, tells me that immense quantities of fish are frequently captured in the Bay of Youghal, but that, there being no adequate demand at the moment, the large surplus of the same—from 50 to 100 tons sometimes—has to be quickly destroyed, as is often the case elsewhere.

I sincerely hope that the bisulphite of lime may prevent such wholesale destruction of nutritive animal food, which, to my thinking, seems a reproach to our civilization, a satire upon our science, when we know that so many will spend hours in turning over dust-heaps—I have seen the poor wretches at their melancholy task—for the purpose of extracting any tails or bones of fish to which some fleshy portions might adhere. These, an old woman in Whitechapel told me some years ago, "makes an old crust more filling," and her scanty meal certainly must have had a flavour about it!

I append some analyses of meat, both in the fresh condition and after it had been preserved by the process to which I am referring—they may serve to show that no diminution of nutritive value is occasioned by the use of the bisulphite.

The Natural Condition.

| Description of Meat. | Water. | Total dry matter. | Nitrogenous matter. | Carbonous matter (fat). | Mineral matter (ash). |
|----------------------|-----------|-------------------|---------------------|-------------------------|-----------------------|
| | per cent. | per cent. | per cent. | per cent. | per cent. |
| Beef | 57.4 | 42.6 | 14.6 | 23.3 | 4.7 |
| Mutton | 48.5 | 51.5 | 13.7 | 34.6 | 3.2 |
| Veal | 63.2 | 36.8 | 17.1 | 14.9 | 4.8 |
| Pork | 44.7 | 55.3 | 9.3 | 44.2 | 1.8 |

Preserved with Bisulphite of Lime.

| | per cent. | per cent. | per cent. | per cent. | per cent. |
|--------------|-----------|-----------|-----------|-----------|-----------|
| | | | † | † | † |
| Beef | 49.2 | 50.8 | 14.1 | 23.5 | 4.9 |
| Mutton | 46.7 | 53.3 | 13.6 | 34.5 | 3.4 |
| Veal | 56.4 | 43.6 | 16.6 | 15.3 | 4.9 |
| Pork | 43.1 | 56.9 | 9.3 | 44.1 | 2.0 |

In the columns marked thus † the results are calculated as if the preserved meat contained the same proportion of water and dry matter as the fresh.

Mr. Ede, of Her Majesty's Victualling-yard, Deptford, has most courteously forwarded a specimen of bisulphitized beef for your inspection, and I dare say will afford us some information respecting it, and also the ordinary methods of preparing meat for the use of the navy, and the importance of securing a plan which will enable us to treat meat without employing a large excess of salt as at present. As regards the details of the process itself, I am sure there are many persons in the room—practical authorities—who can speak of its use in their establishments, and far more to the purpose than I can, although I shall be happy to reply to any questions in relation to this or other processes. I cannot conceive that anything more simple could be devised, as regards the application of the bisulphite, as no tins or other vessels are required for its use, and thus no metallic flavour can be imparted to the meat.

As a recent source of animal food, the extract of meat asks for a little attention at our hands, but I will not detain you long to-night on account of it, as I have arranged to prepare a special paper upon this subject during the present year. A few observations and results, however, will appear in the *Journal*, as I have adopted a mode of comparing the *extractum carnis* of different makers, based upon the proportions, however, of an important meat-principle called kreatin, and specimens of the chief varieties of the extract are before you. As long as we look upon the preparation not as a staple food, but as a most valuable and convenient auxiliary, we cannot go far wrong, but I regret to say that various statements have been made to the effect that the nutritive portions of an entire bullock can be put into the very portable form of a small jar or canister—a proposition of self-evident absurdity.

Having been requested to mention a rough-and-ready method of testing the *extractum carnis*, I may observe that when a little of the preparation is mixed with a small quantity of sulphuric acid (previously diluted with twice its weight of water), and gently heated, there is evolved a peculiar odour, which at once enables an idea to be formed of the kind of meat which has been used in preparing it. The extract is now manufactured in very large quantities in South America, Australia, and in this country. Specimens of all these varieties are before you.

I have not referred to charqui, as that subject has already received much consideration at the hands of this Society, but will simply point to the "Oliden" dried beef on the table, as being the best form of this class of preparations with which I am acquainted.

In concluding this very imperfect notice of our supplies of animal food, I am fully conscious of my utter incapability of doing justice to the subject, especially in the brief space of time allotted on these occasions. I have, however, the consolation of knowing that the several points I have endeavoured to lay before you in my brief crude manner will be enlarged upon, and acquire an interest not their own, from the valuable observations of those whose special experiences will enable them to speak with authority upon the subjects included in the title of this paper.

I should like, however, to ascertain the opinions of this Society, particularly upon the following points:—

1. Whether it would be advisable to take steps for the establishment of a ministerial department for the cognisance of food and agriculture, similar to that existing in the United States.

2. What arrangements for the separation of foreign cattle and other animals would be the most convenient one, and

3. What experiments, upon a practical scale, should be instituted, in order to determine the best method of applying the bisulphite of calcium process, or any other, to the importation of meat from Australia, South America, and elsewhere, in a sound and wholesome condition.

I have to express my best thanks to a number of gen-

tlemen who have liberally supplied me with information, suggestions, and specimens, both numerous and valuable; and I desire specially to express my obligations to Charles Adams, Esq., the honoured representative of the United States, and to several other distinguished members of the diplomatic corps; also to Mr. John Graham, of Notting-hill, and to the various inventors, patentees, and merchants, who have enabled me to illustrate these observations with the specimens before you.

DISCUSSION.

Mr. RUDKIN said he had been for many years engaged in catering for the public, and in so doing had been impressed with the conviction of the importance of the question now under consideration. The economy in food was also a point of great importance. He estimated that the waste which occurred in establishments where ten persons were provided for was sufficient for the support of at least four additional people; and in the private establishments of merchants engaged in business in London two or three dogs were often kept on the bones and remains of meat sent from the table, which would furnish nutritive soup for a great number of people. The true secret of economy in this respect was the "stock pot," which was to be found in every French house, although it was a very difficult matter to introduce it into this country. Passing to the subject more immediately before them, the author of the paper had touched upon a question on which he (Mr. Rudkin) had personally had some experience—that was the supply of foreign meat to be consumed in London. He was connected with the Corporation of London, and had had under his charge, with others, the regulations affecting the supply of foreign cattle for the metropolitan market. His own opinion was, that any attempt to place restrictions on the importation of foreign cattle into this country would have the effect of increasing the price of meat, and the attempts now being made to establish a foreign cattle market separate from the English market were, in his judgment, most unwise; nothing could bring cheap meat but free and open competition. If they had foreign cattle in one market and English cattle in another, they would cease to have that open competition which existed at the present time. If they looked at the statistical returns, they found that during a certain portion of the year there was a large supply of cattle from abroad; and during another portion we received comparatively few. The result was, that at the Copenhagen Cattle-market the English animals had, practically, the monopoly of the supply during a part of the year; and at this season the price of meat was invariably high. During the autumn, from Midsummer-day to the middle of November, there was an immense influx of foreign cattle, which had a great effect in reducing the price of meat. The statistical returns for the last twenty-five years showed that this was so. The consequence of the regulations imposed by the Orders in Council in respect of the late cattle plague was to cause a large number of animals to be slaughtered in Germany and other places on the Continent, and the effect of that on the market here was that for three or four days in a week there was an immense influx of this poor quality of beef and mutton, a large quantity of which arrived in bad condition, and had to be destroyed. His own opinion was that under the system of unrestricted competition the English producer would get a better average price for his meat than he did under existing circumstances. It would be better, also, for the foreign producer, because it opened to him a certain market for his produce. The meat would not be destroyed by the action of the weather, and the result would be a more constant and better supply for the consumer.

Mr. B. VENABLES hoped this subject would be dealt with by the Government in such a way that the people of this country would see that they were being treated in the fairest manner on the important question of increasing

the supply of foreign cattle brought to this country. One point was of especial importance, viz., the mode of transport of cattle from abroad to this country. He thought the Government should interfere to have vessels so constructed as to mitigate to the fullest possible extent the great loss of animals which frequently occurred on the passage; such a saving of the lives of the cattle would be a great public benefit. He trusted we should never return again to the days of protection. If we had had protection during the last twelve months, he was convinced the price of meat would have been tenpence or a shilling per lb. The immense importation of foreign cattle had alone tended to keep down the price, and if we attempted to put restrictions of any kind upon the foreign producer he would send his cattle to those countries where there was a free and open market for them. He was certain it would be prejudicial to the community if a separate market for foreign cattle was established in another district of London, because the animals would be sent there for the purpose of being slaughtered, and the consequence would be to throw the trade into a few hands, and competition would be destroyed, while the live market would be practically monopolised by the English producer. We were only now recovering from the effects of a serious disaster amongst the cattle of this country, and though there was no doubt the disease was brought from abroad, yet they found it prevailed in parts of the country where no foreign cattle ever approached, and that remark especially applied to the establishment of Miss Coutts, where they might suppose every possible precaution against infection was taken, yet the disease found its way there. That visitation he trusted had now ceased in the country, but he ventured to express a hope that a greater mischief would not be introduced by placing restrictions upon the foreign cattle trade.

Mr. PAYNE agreed with those who had preceded him as to the vast importance of the subject before them. There was at the present time on foot what he considered a dangerous movement for a new and separate market for foreign cattle. He felt persuaded if that were carried out the effect of it would be to make meat dearer. The question was, would there be, in the proposed new market, any live market at all; would it not be converted into a large abattoir? Only a few large dealers would then buy the meat, and it would not meet the wants of the butchers who only killed their three or four bullocks per week, because all the animals must be slaughtered on the spot. The result would be that a few of the large carcase dealers would purchase at their own price and prevent competition. That was giving an advantage to the English producers, which they ought not to have in the interests of the general community. The necessity of providing markets for the people was another question, which required a good deal of consideration. He believed they could not do better for the masses of the people than to give them the fullest advantage of the costermonger system. Let the costermonger have free scope, and he would serve the people at the lowest possible prices; but if they placed difficulties and restrictions in his way his prices must be raised. He believed if new markets were formed they would be failures.

Mr. DIXON remarked that so much had been said with regard to the unrestricted admission of foreign cattle, that he thought the question as to how the home supply was to be protected from disease should not be lost sight of. It was generally admitted that the rinderpest came from foreign countries, and it was known to have existed in Hungary and Russia from time immemorial. We wanted every head of cattle that could be brought from abroad; but care must be taken to have them in a state so as not to bring disease among our own home stock. On the subject of the importation of dead meat from abroad, he submitted that thousands of carcases were sent from Aberdeen to London, where they arrived in good condition for the market; there were equal facilities for bringing dead meat from the continental sources of supply, and he be-

lieved it was a matter of indifference to the foreign producers whether they sent the live animals or the carcases to this country, so long as they obtained fair prices for their produce. The great question was to increase the supply of meat, both home and foreign. If the proposed plan of slaughtering foreign cattle at the spot where they were disembarked would prevent the risk of another visitation of disease, it was the duty of every Englishman to hold up his hand for it. He did not agree with Mr. Rudkin that the price of meat was lower during the season of the largest importations of foreign cattle into London. Butchers would tell them that the cheapest time for meat was in the spring of the year, when foreign meat did not come in, because they then got a larger number of English animals, who carried a greater weight of flesh. He submitted it was their duty to do all they could to prevent the introduction of disease among our home stock, and at the same time to encourage as much as possible the importation of foreign supplies. The foot and mouth disease of cattle, as well as pleuro-pneumonia, had almost disappeared in this country, and he had no doubt the restrictions placed upon foreign cattle had greatly tended to that result, and it was to be remarked that the price of meat had gone down since those restrictions had been imposed. This was a question which ought to come before Government, and he hoped it would be fairly argued and dealt with in a practical manner for the benefit of the community at large.

Mr. MORRIS said, being connected with Australia, a part of the world where they had a surplus of cattle, he had been much interested in the subject brought before them this evening, but he must say he hardly thought the author of the paper had solved the question of how they could successfully bring dead meat to this country from such distances as Australia and the River Plate. The importance of the figures laid before them could not be over-rated, for if the average consumption of meat in this country was only 3½ lbs. per head per week, while in Australia it was 10 lbs.—(the rations served to the labouring men were 15 lbs. per head)—to feed the people of this country at that rate would consume the whole stock of Great Britain in one year. That fact alone showed that the people here were not sufficiently fed, and he might say he had been much disappointed with the physical appearance of the labouring population here. Contrasted with the same class in Australia, they were pigmies, even in comparison with those who had been only a few years in that country. These facts showed the necessity for introducing into this country large supplies of food. He begged to inquire, with reference to the specimens of meat preserved by the bisulphite process, whether the experiment had been carried out on a sufficiently large scale to warrant the application of it to meat sent from Australia to this country, and he ventured to submit that if preserved in liquid, whatever the process might be, the meat would lose its flavour. Anyone tasting the meat on the table would find it was without flavour, which he thought arose from its being preserved in some fluid. The great point was to know whether the process had been merely applied to single joints, or whether it was one which could be employed for a large bulk of meat packed closely, so as to admit of its being carried out on a scale that would make it commercially remunerative. He did not agree with the author, that meat from the Plate or Australia could be sold in this country at 2½d. per lb.; he thought the price was likely to be nearer 4d. per lb. He would be glad to hear the grounds on which the author of the paper had arrived at the conclusion that meat frozen lost its flavour, and was liable to rapid decomposition when thawed. If the temperature was lowered below 32° the movement of the particles was arrested, no fermentation could go on, and the meat remained in exactly the same condition as when it was first frozen. This was shown in the remains of animals discovered in Siberia. It appeared that no one had thought of enclosing the meat in vessels, and then

submitting it to the action of cold. If that were done, he would guarantee that the meat would remain in the same condition and retain its flavour. He had himself tasted meat which had been for twelve months without being in contact with ice, and it was the same as if it had been fresh cut by a butcher. He would also be glad to hear Mr. Scott's grounds for the conclusion that frozen meat deteriorated more quickly on being thawed than meat which had not been frozen. If the meat had been allowed to remain in contact with moisture while being frozen, this might occur. It was a subject of the greatest importance that some means should be devised of sending meat from Australia in good condition to this country. It was of better quality than most English meat, for the Australian beef and mutton were of richer flavour than those of this country, so much so, that since he had been here he had been struck with the insipid character of the meat, as compared with that of Australia. Meat intended for exportation should not be over-driven just before being slaughtered. The animals taken to Sydney had to be driven 130 miles almost without food, and that tended to set up a feverish condition, so that that meat would not be proper for exportation; but in the districts of Queensland, Victoria, and New Zealand, there were exhaustless supplies of good meat, if only they could discover a means by which it could be brought into the markets here.

Mr. GRAHAM, in reply to the inquiries of Mr. Morris, with regard to the bisulphite of lime process, said the joint of meat alluded to had not been prepared for shipping purposes, but was merely produced to show what was the effect of dipping the meat into the liquid for only a short time. In the importation of meat from Australia and other distant countries, the patentees had not as yet had much experience, but they hoped to find out the least amount of treatment which would effect the object they had in view. The Food Committee of the Society of Arts had had before them that day a joint of meat which three months ago was steeped for only 2½ minutes in concentrated bisulphite, and then put into a cask and headed up, with a small portion of the liquid at the bottom. The joint had kept perfectly sweet for three months, and he believed it would have remained so as long as the cask was unopened. The Committee were about to send two or three casks of meat, prepared in the same manner, to the Conservatory at Kew Gardens, as a further test of the process in a high temperature. He wished to state that the butchers of London had materially aided in the development of the practical results which had been obtained from this process. Experience had shown that better results were produced by steeping the meat in the pure bi-sulphite for a very short time than for a longer time in a diluted solution. Some casks of meat prepared in London had been sent out to Australia, and had no doubt arrived there by this time. If the experiment was successful, it would certainly be as easy to send meat from that country to this as it was to send it from England there. In November last an experiment was made under the supervision of the Food Committee, in which the carcasses of two sheep were, immediately after being slaughtered, and the blood-vessels cleansed by water, injected with a solution of the bi-sulphite; a leg of that mutton had been cooked that day and it was perfectly sweet. He believed if carcasses of meat were to be sent from Australia the injection process would have to be resorted to.

Mr. JONES thought the current of thought should be directed rather to the increase of the quantity of the home production than to bringing meat from abroad. He had under his own management a few acres of land, on which were formerly kept only five head of cattle; he now kept nineteen; and if that same increase was made general, we should be independent of foreign supplies of meat, as well as, in a great measure, of grain; inasmuch as the more cattle there were kept the more manure would be produced for the increased fertilization of the land. He thought it

would be very much to be regretted if foreign cattle were to be allowed to mix again with our own, half ruining the farmers of the country. He suggested that an advantageous outlet for the locked-up capital of the country would be afforded by advances of money to farmers, in whom they had confidence, to enable them to farm better, and add to the productive capabilities of the country.

Mr. W. L. SCOTT, in reply to the observations upon the paper, said, with regard to what had fallen from Mr. Rudkin as to the manufacture of soup in large quantities, he thought it would not be found to suit the *physique* of the English people so well as it did that of their neighbours across the channel. Mr. Venables' remarks, with reference to the importance of constructing special ships for cattle, he fully endorsed, and he hoped they would fall on fruitful soil in that room. Mr. Dixon showed very properly that if they went on importing cattle without taking due precaution against disease, on the one hand they might have 60,000 cattle brought in and, on the other hand, they might destroy the same number of our own cattle of double the weight, which would be "six of one" and "a dozen of the other," and we should be seriously the losers. Mr. Morris made some remarks, which were partly replied to by Mr. Graham. With regard to the deteriorating effects of freezing upon meat, he (Mr. Scott) could only say that the results he had stated were derived from actual experiments made by himself. The deterioration of the meat consisted in its being rendered, to a great extent, indigestible, and it produced dyspeptic effects upon persons who ate it. Moreover, on exposure to the air, the frozen meat decomposed much sooner than meat which had not been so treated. With reference to Mr. Graham's remarks upon the injection of carcasses with bisulphite, he thought the simpler process of soaking the meat would be found to answer best; and with regard to the transmission of large quantities of meat from Australia, if it were packed in canvass bags, casks might be dispensed with, and he would guarantee that the meat would arrive in this country in good condition. Mr. Jones's remarks as to the desirability of a portion of the locked-up capital of the country being applied to the improvement of agriculture, would, no doubt, commend themselves to many; but the misfortune was no one knew where to lay their hands on that capital, or where to find people who would advance their money, trusting to providence and good crops for the return of it.

The CHAIRMAN, in proposing a vote of thanks to Mr. Scott for his paper, said, with regard to the question of markets, the Food Committee of the Society was considering that subject, and if any gentleman had any suggestions to offer to them an opportunity of doing so would be afforded upon his communicating with the secretary. The Committee had already gone into many of the questions brought forward this evening, and they were at present engaged in testing the results of Messrs. Medlock and Bailey's process of preserving meat. It was not to be understood that the committee had made up their minds on the merits of that or any other process; but when they had concluded their investigations their opinions would, of course, be embodied in a report. With regard to Mr. Morris's proposal for sending frozen meat from Australia, the Committee would be happy to hear that gentleman's views on the subject. He had now to make a proposition which he was sure would be warmly responded to, viz., that their best thanks be given to Mr. Scott for the paper he had read. He had introduced a very important subject to their attention, and had brought before them a vast amount of interesting information, and in every way he deserved the expression of their gratitude for the very valuable paper he had read.

The vote of thanks was then passed and acknowledged.

The paper was illustrated by various specimens of meat, fish, and game, preserved by Messrs. Medlock and Bailey's process; also by specimens of meat, &c., preserved by

Professor Redwood's process; and by that of the Australian Meat Company. Numerous samples of *extractum carnis* and other preparations of meat were also shown.

Proceedings of Institutions.

YORKSHIRE UNION OF MECHANICS' INSTITUTES.—At a meeting of the Central Committee of this Union, held in Leeds on the 13th inst., Mr. E. Baines, M.P., president, in the chair, on the motion of Mr. Thomas Wilson, vice-president, seconded by Mr. James Hole, hon. sec., it was unanimously resolved—"That the report of Mr. Henry H. Sales, the agent of the Union, on technical education in Yorkshire, be laid before the Government." "That the Central Committee, in submitting this report to the Government, beg to recommend that a Royal Commission or Parliamentary Committee be appointed to make an inquiry into the present state of technical education in this country and on the Continent, with a view to devising such methods for its improvement in England as may render it more commensurate with the wants and conducive to the prosperity of this great manufacturing community." "That the Central Committee think it their duty to draw the special attention of the Government to the want of properly trained and qualified teachers of science in this country, and to the consequent inefficiency of the scientific instruction given in mechanics' and other popular institutions and evening classes, which are otherwise capable (with efficient teachers) of rendering the most valuable aid to practical science." "That the Central Committee would also express their belief that technical colleges or schools, of a superior kind, might, with the greatest advantage, be established in the principal centres of manufacturing industry in the United Kingdom."

NATIONAL EDUCATION.

The following summary of the opinions which peers and members of Parliament have lately expressed on national education, will be useful at the present time:—

Acland, T. D. (M.P. for North Devon).

October 2, 1867 (at West Buckland).—In favour of rating.

Akroyd, E. (M.P. for Halifax).

January 8, 1868 (at Halifax).—In favour of technical instruction by means of mechanics' institutes.

February 6, 1868 (at Halifax).—In favour of developing the existing means of education, and against compulsory legislation.

Baines, E. (M.P. for Leeds).

October 11, 1867 (at Manchester).—In favour of extending present system (but without interference in religion); of further half-time measures, and of permissive rating.

October 31, 1867 (at Huddersfield).—In favour of establishing schools for technical instruction in several manufacturing centres.

November 27, 1867 (about) (at meeting of Associated Chambers of Commerce).—Remarks on the deficiency of technical instruction.

December 30, 1867 (at Leeds).—In favour of state interference in technical instruction.

Baxter, W. E. (M.P. for Montrose).

September 10, 1867 (at Dundee).—In favour of rating, and of entirely secular instruction in aided schools.

Bazley, Thomas (M.P. for Manchester).

October 12, 1867 (at Manchester).—In favour of compulsory education.

January 16, 1868 (at Manchester).—In favour of compulsory rating.

Beach, Sir M. E. (M.P. for East Gloucestershire).

September 26, 1867 (at Cirencester).—In favour of more liberal grants to rural schools; against employment in agricultural work of children under 12 or 13, but against the half-time system in rural districts.

Bright, Jacob (M.P. for Manchester).

January 15, 1868 (at Manchester).—In favour of compulsory rating in places where schools are wanted.

Bright, John (M.P. for Birmingham).

February 5, 1868 (at Birmingham).—Against state interference in technical instruction, and against compulsory measures of education.

Bruce, Right Hon. H. A. (M.P. for Merthyr Tydvil).

November 12, 1867 (at Merthyr Tydvil).—In favour of extended operation of conscience clause, and against compulsory measures at present.

December 11, 1867 (at Halifax).—In favour of local rating and local organisation ("permissive system"); of the department (Science and Art) system, and of opening the universities to all.

Canterbury, the Archbishop of.

January 28th, 1868 (at Tunbridge-wells).—In favour of the denominational system, with a conscience clause, and against compulsory measures.

Childers, H. C. E. (M.P. for Pontefract).

November 8th, 1867 (at Pontefract).—In favour of a compulsory, or of a "national" system.

Clinton, Lord E. P. (M.P. for North Notts).

January 27th, 1868 (at Mansfield).—In favour of compulsory attendance.

Cork, Earl of.

October 8th, 1867 (at Bath and Wells Diocesan Board).—In favour of the voluntary system, supplemented by state aid, but without the requirement of a teacher's certificate.

Cowper, Rt. Hon. W. (M.P. for Hertford).

November 8th, 1867 (at Romsey).—In favour of compulsory rating, and of Irish system as regards religious instruction.

Crossley, Sir Fras., Bt. (M.P. for West Riding, North).

November 20th, 1867 (at "London Tavern").—In favour of the extension of the Factory Acts to rural districts, and against rating.

Cecil, Lord Eustace (M.P. for South Essex).

December 31st, 1867 (at Maldon).—Against compulsory measures, and in favour of religious instruction in primary schools.

De Grey and Ripon, Earl.

October 31st, 1867 (at Huddersfield).—In favour of rating, and of utilising educational endowments.

Dixon, George (M.P. for Birmingham).

January 15th, 1868 (at Manchester).—In favour of compulsory education.

January 23rd, 1868 (at Society of Arts).—In favour of state aid to technical instruction.

Estcourt, Rt. Hon. T. Sotherton.

January 28th, 1868 (at Tunbridge-wells).—In favour of the denominational system, with a conscience clause, and against compulsory legislation.

Fawcett, Henry (M.P. for Brighton).

January 27th, 1868 (at Brighton).—In favour of extending the Factory Laws to every branch of industry.

Forster, W. E. (M.P. for Bradford).

November 27th, 1867 (at meeting of Associated Chambers of Commerce).—In favour of adopting the continental combination and system combined with local enterprise; advocating state interference in technical instruction, and deprecating the delay of a commission.

January 15th, 1868 (at Manchester).—In favour of

compulsory rating in districts where means of education are wanting.

September 10th, 1867 (at Bradford).—In favour of secular instruction.

Fortescue, Right Hon. Chichester (M.P. for Louth Co.).

September 28, 1867 (at Dundalk).—In favour of the Department of Science and Art system.

Gibson, Right Hon. T. M. (M.P. for Ashton).

January 28, 1868 (at Ashton).—In favour of utilising the present denominational system, and of rating for purely secular instruction, of conscience clause, and of Mr. Bruce's scheme generally.

Gladstone, Right Hon. W. E. (M.P. for South Lancashire).
December 18, 1867 (at Oldham).—In favour of conscience clause, and of state aid to secular schools.

December 20, 1867.—Religious difficulties "must be put out of our way."

Göschel, Right Hon. J. G. (M.P. for London).

January 15, 1868 (at Manchester).—In support of Mr. W. E. Forster's views.

Grant Duff, M.E. (M.P. for Elgin, &c.).

September 6 (at Dundee).—In favour of rating and of extension of half-time system.

Granville, Earl, K.G.

August 27, 1867 (at Manchester).—In favour of extended means of science instruction.

August 28 (at Hulme).—In favour of extending the operation of the conscience clause.

Graves, G. R. (M.P. for Liverpool).

December 13, 1867 (at Liverpool).—In favour of further discussion before legislating.

Hartington, Marquis of (M.P. for North Lancashire).

October 18, 1867 (at Accrington).—In favour of extending the present system with modifications.

Hope, A. J. Beresford (M.P. for Stoke-on-Trent).

January 28, 1868 (at Tunbridge Wells).—Against compulsion and rating.

Hughes, T. (M.P. for Lambeth).

January 8, 1868 (at Halifax).—In favour of compulsory education, and of improved means of technical instruction.

Lichfield, Earl of

December 26, 1867 (at Stoke-on-Trent).—In favour of extending the half-time system.

Lowe, Right Hon. R. (M.P. for Calne).

November 1, 1867 (at Edinburgh).—In favour of state aid to secular instruction, of local rating and management, and of compulsory establishment of schools where needed.

January 23, 1868 (at Liverpool).—In favour of conscience clause in every school receiving state aid, of local management under central control (and management of inspection, &c.), and proposing to defer measures for compelling attendance.

Lowther, W. (M.P. for Westmoreland).

January 8, 1868 (at Appleby).—In favour of compulsory education, and of establishing technical schools.

Moncreiff, Jas. (M.P. for Edinburgh).

November 2nd, 1867 (at Edinburgh).—In favour of liberal educational measures for Scotland, and against its being made a party question.

Osborne, Bernal (M.P. for Nottingham).

November 11th, 1867 (at Nottingham).—Doubting feasibility of a compulsory rate.

Oxford, Bishop of.

January 28th, 1867 (at Culham).—Against compulsion and rating.

Russell, Earl, K.G.

January 23rd, 1868 (at Society of Arts).—In favour of compulsory education.

Samuelson, B. (M.P. for Banbury).

January 10th, 1868 (at Birmingham).—In favour of state interference in technical instruction.

January 16th, 1868 (at Manchester).—Against the half-time system.

Stansfeld, James (M.P. for Halifax).

December 10th, 1867 (at Dewsbury).—On the difficulty of educating the obscure poor in large towns.

December 11th, 1867 (at Halifax).—Against permissive measures.

January 8th, 1868 (at Halifax).—In support of Mr. Forster's views as to the compulsory establishment of schools.

February 4th, 1868 (at St. James' Hall, London).—In favour of compulsory attendance.

Sykes, Colonel (M.P. for Aberdeen).

September 10th, 1867 (at Dundee).—In favour of compulsory education.

Villiers, Right Hon. C. P. (M.P. for Wolverhampton).

December 30th, 1867 (at Willenhall).—In favour of the American system, and of technical instruction by means of Mechanics' Institutes.

Walter, J. (late M.P. for Berks).

October 15th, 1867 (at Culham).—In favour of payment on results in all primary schools, and against the secular system.

Wilson Patten, Col. (M.P. for North Lancashire).

October 18th, 1867 (at Accrington).—Against the secular system, and in favour of technical instruction.

Manufactures.

PROPOSED IRON TRADE CONFERENCE.—During the last twelve months the attention of the iron trade has been invited to many features connected with the relations of this industry to foreign competitors, to the development of the iron manufacture in other countries; to proposed methods for improving the quality and economical production of iron and steel, and to many subjects of considerable importance to the interests of the British iron trade. It is therefore thought that a conference of British iron manufacturers might advantageously be held during the next general meeting of the associated chambers of commerce in London, say on or about the 6th of March next, when such subjects as the following might be discussed:—Statistics of Home and Foreign Iron Trade:—Measures to be adopted for obtaining reliable statistics of the coal, pig iron, malleable iron, and steel trades of Great Britain, and other countries where these industries are located. Desirability of requesting the Board of Trade to undertake the enquiry, by means of the consular service, or by special commission. Foreign Competition:—Natural advantages possessed by our foreign competitors: advantages resulting from better methods of manufacture, economical processes, utilization of waste products, or cheaper labour. Manufacture:—Means suggested for increasing the effective work of men employed in the different branches of iron manufacture; for encouraging greater efficiency and economy in the puddling process; for extending the application of machinery to the iron manufacture; for securing skilled managers in the several departments of the manufacture. Legislation:—Enactments in operation or proposed which press upon the iron trade: measures considered desirable to get introduced by the legislature. Labour:—Information bearing upon experiments which have been made with a view to promote better understanding between employers and employed. An interchange of opinions upon the above subjects, between the leading members of the British iron trade, will no doubt tend to elicit much valuable information.

Commerce.

BEETROOT SUGAR.—There are 63 manufactories of sugar in Lithuania, Podolia, and a part of Bessarabia, of which half are also refiners. The smallest use from two to four presses, the largest 22. 3,200,000 hectolitres of beet-roots are bought for the manufactories. The largest manufactory belongs to a company of shareholders, who buy the beetroots of the neighbouring proprietors, and beetroots generally realise 3fr. 50c. the korse, a measure equivalent to 1 hectolitre 28. Nearly 9,000 workmen are employed, whose wages amount to about 16 millions of francs. Almost all the sugar not consumed in the country is sold to Russia. There are 1,428 distilleries, in which a large number of workmen are employed, and their manufacture represents the value of 80 millions of francs. This industry has developed considerably. In the provinces, where the soil was suitable for the cultivation of potatoes, the proprietors drew from that source almost all their revenue. But since the increase of the tax on the manufacture of spirits many manufactories have been compelled to close. The manufacture of alcohol from beetroot is not practised in Poland.

Colonies.

SAVINGS BANKS IN VICTORIA.—The returns for the year ending 30th June, 1867, show that the total amount received from depositors during the year was £348,554 19s.; the total amount of repayments to depositors £406,799 6s. 11d.; and the total amount of interest allowed to them was £22,653 17s. 2d. The total number of accounts opened during the same period was 6,102 (of which number 1,298 were old accounts re-opened); and of accounts closed, 5,829. The interest paid to depositors on accounts closed during the twelve months, as also the interest carried to the credit of depositors on accounts open at 30th June last, was computed, as ordered by the Commissioners of Savings Banks, at the uniform rate of four per cent. per annum, that being the maximum rate allowed by the Savings Banks Statute 1865. The total amount of depositors' balances at the 1st July, 1866, having been £642,028 13s. 2d., and at 1st July, 1867, £606,438 2s. 6d., the difference is a decrease of £35,590 10s. 9d. The total number of depositors' accounts open at 1st July, 1866, having been 16,985, and at 1st July, 1867, 17,258, the difference is an increase of 273. The average balance of each depositor was £35 2s. 9½d., the average amount of the deposits was £8 12s. 7½d., and of withdrawals £13 15s. 7¼d. per depositor.

Notes.

EXHIBITION OF APPLIED ART IN PARIS.—The Minister of the French Imperial Household has announced to the Committee of the Paris Union Centrale that, after the closing of the exhibition of the works of living artists, which opens on the 1st of May and closes on the 15th June, the Palais de l'Industrie will be placed at the disposition of the committee. The latter propose to organise a tripartite exhibition on a large scale, comprising:—1st. A collection of objects exhibiting the application of art to industrial purposes; 2nd. The works of all the schools of design in France; and, 3rd. a collection of Oriental productions, ancient and modern. The date is not yet mentioned, but it can scarcely be earlier than August. This exhibition will supply an excellent opportunity of judging of the general value of art-education and art-workmanship in France.

HORSE SHOW IN PARIS.—The Société Hippique Française is fitting up the ground floor of the Palais de l'Industrie in the Champs Elysées, the use of which

it has acquired for five years, for an exhibition to take place during the first fortnight in April. The central portion is being prepared for the exercise and showing of the horses, and tribunes are being erected for visitors. There will be stable room for about five hundred horses, and prizes awarded to the amount of 60,000 francs (£2,400). The society held an exhibition of the same kind and in the same place the year before last, but it is understood that future shows are to be of a much more extensive kind. The main object of the society is, we believe, to induce improvement in the breaking and management of horses for riding and driving. Military horsemanship forms a feature of the plan, and the officers of the cavalry schools took an active part in the former exhibition.

MEETINGS FOR THE ENSUING WEEK.

- MON.....** Social Science Assoc., 8. "Report on some of the Matters now under the Consideration of the Royal Commission on Judicature."
R. Geographical, 8½. Mr. C. R. Markham, "Geographical Results of the Abyssinian Expedition to Jan. 22nd, 1868."
Actuaries, 7. Mr. Makeham, "On the Values of Annuities Certain."
- TUES ...** Medical and Chirurgical, 8½.
Civil Engineers, 8. 1. Renewed discussion on "The Supporting Power of Piles, &c." 2. Mr. C. P. Sandberg, "On the Manufacture and Wear of Rails."
Ethnological, 8.
Royal Inst., 3. Professor Tyndall, "On the Discoveries of Faraday."
- WED ...** Society of Arts, 8. Mr. Hyde Clark, "On a Daily Mail Route to India."
Geological, 8. 1. Mr. C. Babbage, "Notes on the Formation of the Parallel Roads of Glen Roy." (Communicated by the President.) 2. Mr. D. Mackintosh, "On the Origin of smoothed, rounded, and hollowed Surfaces of Limestone and Granite." 3. Mr. D. Mackintosh, "On the Encroachment of the Sea in the Bristol Channel." 4. Mr. D. Mackintosh, "On a Striking Instance of apparent Oblique Lamination in Granite." 5. Mr. T. M'K. Hughes, "On the Two Plains of Hertfordshire and their Gravels."
Archæological Assoc., 8½.
- THUR ...** Royal, 8½.
Antiquaries, 8½.
Zoological, 8½.
Philosophical Club, 6.
Mathematical, 8.
Royal Inst., 3. Professor Tyndall, "On the Discoveries of Faraday."
Society of Fine Arts, 8. (In Great Room of Society of Arts.) Mr. F. Y. Hursthouse, "On the Pictures of James Barry, R.A."
- FRI.....** Quekett Microscopical Club, 8.
Royal Inst., 8. Mr. A. Vernon Harcourt, "On Chemical Actions."
R. United Service Inst., 3. Commander Philip H. Colomb, R.N., "The Naval Department of the French International Exhibition of 1867."
- SAT** Royal Inst., 3. Professor Roscoe, "On the Non-Metallic Elements."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

- Par.**
Numb.
24. Thames River—Correspondence.
Delivered on 10th December, 1867.
- SESSION 1867.**
566. Chain Cables and Anchors—Return.
Delivered on 11th December, 1867.
12. Bill—Sale of Liquors on Sunday.
Delivered on 12th December, 1867.
Public General Acts—Cap. 1 to 6.
Delivered on 13th December, 1867.
18. Foreshores—Memorandum.
- SESSION 1867.**
518. Tenure (Ireland) Bill—Lords Report.
Delivered on 19th December, 1867.
24. (1.) Thames River—Return.
36. Hops—Return.
Delivered on 19th December, 1867.
38. Augmentation of Benefices—Return.
East India Communications—Communication from Baron Baudé.
- SESSION 1867.**
431. (A. VI.) Poor Rates and Pauperism—Return (A).
Delivered on 23rd December, 1867.
10. Storm Warnings—Papers.

SESSION 1867.

538. Navy (Ships "Frederick William," &c.)—Correspondence.

*Delivered on 24th December, 1867.*25. Bill—Metropolitan Foreign Cattle Market.
Abyssinia—Pamphlet and Appendices relating to the Routes in.*Delivered on 27th December, 1867.*

Trade and Navigation of the United Kingdom with Foreign Countries and British Possessions—Annual Statement.

Delivered on 28th December, 1867.

13. Education—Letter.
29. East India (Cession of Berar)—Correspondence.
31. Mortality and Marriages (Scotland)—Return.
32. St. Andrew's University Graduates—Return.
24. Insolvent Debtors—Returns.
42. Postal Contracts—Return.
44. Militia—Return.

Delivered on 31st December, 1867.

SESSION 1867.

46. (xi.) Trade and Navigation Accounts (30th November, 1867).

Delivered on 3rd January, 1868.

23. Navy (First Class Boys, &c.)—Return.
28. Rangoon and Western China—Memorials, &c.
28. (i.) Rangoon and Western China—Survey Report.

SESSION 1867.

564. Vessels not Armour Plated—Return.

Delivered on 6th January, 1868.

SESSION 1867.

468. Wexford Harbour—Mr. Cooke's Report, &c.
478. (i.) Army (India and the Colonies)—Index to the Report.
496. (i.) Mines—Index to the Report.

Delivered on 9th January, 1868.

11. Dwelling Houses—Return.
40. Poor Law (Walsall Workhouse)—Report.

SESSION 1867.

223. (i) Courts of Law, &c., Part II.—Return.

Delivered on 11th January, 1868.

13. Bill—Compulsory Church Rates Abolition.
39. Ceylon—Extracts of Despatch.

SESSION 1867.

562. Navy (Boys and Seamen)—Return.

Delivered on 15th January, 1868.

24. Bill—Public Schools.

Delivered on 16th January, 1868.

25. East India (Engineers' Establishments, &c.)—Return.

Patents.

From Commissioners of Patents' Journal, February 14.

GRANTS OF PROVISIONAL PROTECTION.

- Beer-engines—328—B. Hayne.
Blinds, window sun—329—W. E. Newton.
Boilers—365—J. West.
Boilers, &c., incrustation in—384—J. Webster.
Bolts, nuts, and washers—340—H. Chapman.
Bones, treating—364—J. H. Johnson.
Boot and shoe lasts—304—W. March, jun.
Boot and shoe lasts, supports for—370—W. Wallis and G. Mant.
Boots and shoes—322—J. Grimes.
Bottles, feeding—192—T. G. F. Dolby.
Bottles, feeding—332—J. Thompson.
Brakes, self-acting—316—W. E. Newton.
Bread, &c., cutting—324—M. A. Hamilton.
Bridges, suspension—344—S. E. Howell.
Buckets, metal—334—C. H. Adames.
Candles—291—C. E. Brooman.
Casks, &c., forcing liquids from—380—T. Cook.
Chimneys, sweeping—368—H. B. Wright.
Clog soles, &c., manufacturing—390—R. J. Jones.
Colouring matters—225—C. E. Brooman.
Cotton balls, &c., manufacturing—388—R. D. McKellen.
Engines—217—W. E. Newton.
Engines—325—W. Hartnell and S. Guthrie.
Engines—337—J. H. Johnson.
Engines—347—A. M. Clark.
Engines, cleaning carding—359—J. Tolson.
Engraving machines—349—G. Moulton.
Fabrics, cutting into lengths—341—J. Mitchell, jun., & G. T. Graham.
Fans, rotary blowing—323—H. Aland.
Fire bars—374—J. Lewis and R. and E. Alston.
Fire escapes—348—G. Clarke.
Flax, &c., hackling and sentencing—362—J. Combe and J. Barbour.
Food, preserving—376—J. Dewar.
Furnaces—319—W. R. Lake.
Furniture expanders, &c.—396—H. Moore and J. Hamilton.
Fuses, percussion—386—J. Pettman.
Gas, &c.—354—A. M. Clark.
Glass, substitute for—345—J. Livesey.
Grain, &c., heating and drying—360—J. and W. Weems.
Gunpowder, &c.—342—E. Bolton.

- Hat covers—3086—W. E. Gedge.
Head, &c., coverings for the—355—D. Murray.
Horse-shoes, &c.—398—J. Hay.
India-rubber, &c., cutting washers of—373—E. Grether & M. Bailey.
Iron and steel—303—W. H. Richardson and W. Beardmore.
Iron and steel—321—J. Radcliffe.
Iron, &c., removing impurities from—327—T. Rowan.
Iron ores, &c., treating—352—H. Aitken.
Ladders, &c.—3460—S. L. Worth.
Lamps—382—T. Scott and R. Mowat.
Lamps, miners'—375—L. Desens.
Lamps, miners' safety—203—E. Thomas.
Leggings, &c.—367—W. R. Lake.
Light, regulating and increasing artificial—292—G. N. Sanders.
Liquids, manufacturing—335—E. Fleet.
Locomotion, &c., aerial—392—M. P. W. Boulton.
Looms—243—J. Goulding.
Looms—366—C. Richardson.
Lozenges, &c., embossing, &c.—294—A. Pickering.
Madder, extracting colouring matter from—227—C. E. Brooman.
Mattresses, &c., spring—361—M. A. Wilson.
Motive-power machines—300—A. C. Pilliner and J. C. Hill.
Motive-power, transmitting—346—J. Frame.
Mowing and reaping machines—394—W. E. Newton.
Pavement—296—W. R. Lake.
Photographic apparatus—363—J. M. Domenech and F. P. Jonte.
Refrigerators—377—R. Morton.
Ships, steering—343—G. L. Scott.
Sinks, &c.—351—R. C. Smith.
Spinning or twisting apparatus—378—E. A. Morgan.
Spinning, &c., machines—320—B. Dobson, W. Slater, and R. Halliwell.
Stoves, hot-air—358—B. Ford.
Stoves, &c.—372—R. A. Jones.
Sulphur, &c., burning, &c.—270—A. MacDougall.
Threshing machine frames—314—C. Riley.
Tubes, metallic—350—J. V. Jones and G. J. Williams.
Valves—205—J. F. Spencer.
Valves, &c.—357—C. E. Brooman.
Winding machines, &c.—262—J. and T. A. Boyd.
Wood, tobacco, &c., cutting—298—J. Brown.
Wood, &c., turning and cutting—336—J. Walker and J. Hudson.
Wool, &c., cleansing, &c.—318—J. H. Johnson.
Wrenches—333—A. M. Clark.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

- Metals, heating and welding—444—W. B. Adams.
Railway switches, &c.—443—W. R. Lake.
Spikes, split—442—W. R. Lake.
Water-closets, &c.—436—J. A. Nicholson.

PATENTS SEALED.

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|-----------------------------|---------------------|
| 2355. J. Day and W. Dorber. | 2511. W. H. Kilson. |
| 2358. R. Joseph. | 2537. D. Payne. |
| 2367. M. Frow. | 2565. J. Whittome. |
| 2371. W. W. Pocock. | 2575. J. Davies. |
| 2373. W. R. Goulty. | 2749. T. Weston. |
| 2378. C. E. Brooman. | 3346. W. R. Lake. |
| 2391. C. E. Hall. | 3500. W. R. Lake. |
| 2410. J. G. Marshall. | |

From Commissioners of Patents' Journal, February 18.

PATENTS SEALED.

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| 2374. T. Tunstall. | 2423. G. Allibon and E. Wilson. |
| 2386. H. Cridland. | 2424. J. Cash and J. Cash, jun. |
| 2387. A. S. Stocker. | 2427. J. Hanson. |
| 2390. W. Bostock. | 2433. F. J. Cleaver. |
| 2392. W. Thomas. | 2447. J. E. Boyce and R. Harrington. |
| 2393. J. Robinson and J. Smith. | 2460. A. Stewart. |
| 2394. G. Luyckx. | 2471. A. M. Clark. |
| 2395. C. W. Siemens. | 2501. W. Weldon. |
| 2397. J. Goucher. | 2516. J. S. Henderson and J. Macintosh. |
| 2398. J. M. Napier. | 3095. W. Day. |
| 2399. J. Mangnall. | 3322. S. Amphet & J. B. Fenby. |
| 2400. T. Widdowson. | 3471. S. Goldstein. |
| 2404. S. Lynes. | 3526. J. R. Baillie. |
| 2405. R. King, J. Lowden, and W. Gartside. | 3. W. R. Lake. |
| 2409. J. and F. J. Jones. | |
| 2412. T. W. Lawson. | |

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

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| 384. D. H. Barber. | 510. J. G. Hughes. |
| 387. C. Atherton and A. H. Renton. | 416. R. J. Jones. |
| 401. R. W. Thomson. | 450. J. Thompson. |
| 402. L. H. G. Ehrhardt. | 469. J. Graham. |
| 437. R. H. Emerson. | 473. J. G. N. Alleyne. |
| 443. E. B. Wilson. | 508. W. S. Mappin. |
| 404. W. Adams. | 507. S. Whitfield. |
| 432. M. Lane. | 451. R. Smith. |
| 436. G. T. Humphris. | 452. R. Hill and R. Tushingham. |
| 408. E. J. C. Welch. | 816. L. A. Leins. |

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

399. J. H. Johnson.